This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

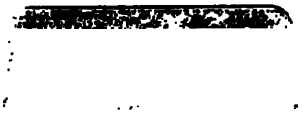
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`



PUBLICATIONS OF THE UNIVERSITY OF PENNSYLVANIA

SERIES IN

Philology Literature and Archæology

VOL. VI

RESEARCHES UPON

THE ANTIQUITY OF MAN

IN THE DELAWARE VALLEY AND THE EASTERN UNITED STATES

BY

HENRY C. MERCER

CURATOR OF THE MUSEUM OF AMERICAN AND PREHISTORIC ARCHAEOLOGY
AT THE UNIVERSITY OF PENNSYLVANIA

1897

GINN & COMPANY
Agents for United States, Canada and England
9–13 Tremont Place, Boston, U.S.A.

MAX NIEMEYER
Agent for the Continent of Europe
Halle, a. S., Germany.

RESEARCHES UPON

THE ANTIQUITY OF MAN

AT AN INDIAN STONE BLADE QUARRY IN THE DELAWARE VALLEY, AT A MORTUARY DEPOSIT OF INDIAN SKELETONS IN MARYLAND, IN CERTAIN SHELL HEAPS ON THE COAST OF MAINE, AND AT THE DURHAM CAVE, AND INDIAN HOUSE ROCKSHELTER IN PENNSYLVANIA

Y054

BY

HENRY C. MERCER

CURATOR OF THE MUSEUM OF AMERICAN AND PREHISTORIC ARCHAEOLOGY
AT THE UNIVERSITY OF PENNSYLVANIA

THE NEW YORK
PUBLIC LIBRARY
134116
ASTOR, LENOX AND
TILDEN FOUNDATIONS.
1898.

THE ASTOR LIBRARY

THE Papers of this Series, prepared by Professors and others connected with the University of Pennsylvania, will take the form of Monographs on the subjects of Philology, Literature, and Archæology, whereof about 200 or 250 pages will form a volume. Each Monograph, however, is complete in itself.

The price to subscribers to the Series will be $2.00 per volume; to others than subscribers the numbers will be sold separately at the regular prices.

It is the intention of the University to issue these Monographs from time to time as they shall be prepared.

Each author assumes the responsibility of his own contribution.

NEW YORK
PUBLIC
LIBRARY

TO

CHARLES CUSTIS HARRISON

PROVOST OF THE UNIVERSITY OF PENNSYLVANIA
IN WHOSE KIND HELP THE INVESTIGATION AT
GADDIS' RUN FOUND ITS EARLIEST APPROVAL
AND ENCOURAGEMENT, THE FOLLOWING RECORD
OF ARCHAEOLOGICAL RESEARCH

IS

RESPECTFULLY DEDICATED

CONTENTS.

THE ANTIQUITY OF MAN IN THE DELAWARE VALLEY.

AN INQUIRY AS TO THE AGE OF SOME OF THE CHIPPED STONES CALLED "TURTLEBACKS."

By HENRY C. MERCER.

CHAPTER I.

INTRODUCTION.

No class of archaeological specimens has attracted more attention in late years than the family of roughly chipped points or ovate stone blades of various shape, known in France as *coups de poing* and *haches*, in England as Drift implements or implements of Drift type, and in America as Trenton gravel specimens, "paleoliths," "turtlebacks," or looked at from a certain point of view, as wasters, "rejects and failures." Made of jasper, argillite, ryolite, quartz, chert, novaculite, and many other chippable stones on this side of the Atlantic — sometimes of quartzite in Spain, and chiefly of flint in England and France, a general similarity was once supposed to run through them all, but the more they are studied, the more they seem to vary in make, shape, and purpose. There are large chips among them in France (at Abbeville) worked only on one side, small knives classed with them in England (at Caddington), and thick disc-like forms, flat on one side, of the same category

in America (at Trenton). But the great majority of them—thick, clumsy, and heavy—present a leaf-like shape tapering to a sort of rude point at one end. (See Figs. 1, 2, 4, 6, 16, 24, 30, etc.)

Told that they are implements, the visitor to the museum, who often looks in vain for signs of wear in their cutting edges, wonders how they were used, whether grasped in the hand, as is sometimes supposed, or mounted in hafts of wood or bone.

Boucher de Perthes found them in the Somme gravels associated with the bones of the mammoth and rhinoceros, which at once set the geological stamp of great antiquity upon them, and roused an interest in them and any other stones that might happen to look like them, which has never flagged. They were discovered in southern England, where Messrs. F. C. J. Spurrell and W. G. Smith found workshops, at which they had been made, covered by ancient deposits of stratified gravel. They were gathered in Spain, India, and Japan; and General Pitt-Rivers detected some in a hard alluvial stratum under an Egyptian temple. No pottery, no arrowhead, no polished stone tool was admitted to have been found with them in their original beds in the Drift, and the inference was that they represented a very early stage in the evolution of human handicraft, when man, unequipped with arts and inventions, had scarcely begun his struggle with the forces of nature.

From the worn look of many of the points and the original position of the specimens, floods seemed to have scattered them in the gravels where they lay with Pleistocene shells and bones, and the more Darwinism gained ground the more these stones were taken as landmarks in the whole vista of human development. They took us back, if not to the apish beginning, further down the line than we had ever gone before.

So great was the difference between their appearance, geological position, and relationship to fossils and that of all other ancient stones and tools previously studied that the Stone Age itself had to be subdivided for their sake, and Sir John

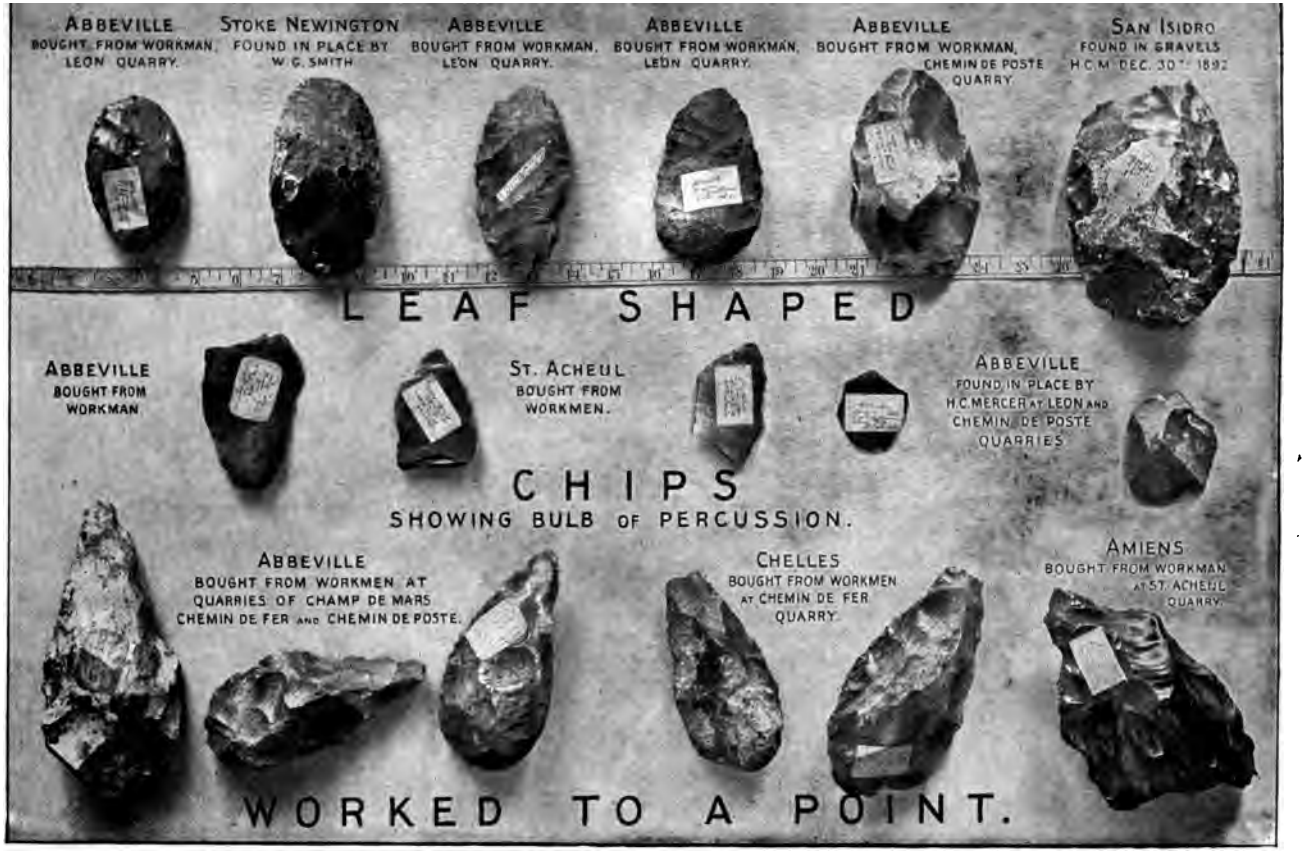


FIG. 1. — **Typical illustrations of certain of the most ancient examples of human handiwork in existence, flint chips and blades (whether finished or unfinished), found in the Pleistocene river gravels of England, France, and Spain, and made by European savages who were contemporaries of the woolly rhinoceros, hippopotamus, fossil elk, and mammoth.**

Lubbock coined the word "paleolithic" (old stone) to denote the dawn of the human period so far known, when glaciers came and went in Europe, when now the Arctic reindeer, now the Torrid hyena roamed the valleys of France and England; and when man, without metals and polished stone, without domestic animals, and ignorant of pottery and the bow, struggled for existence in western Europe with the woolly rhinoceros, the hippopotamus, and the mammoth.

The varying history, however, and the number and variety of these stones that came at last to invade the museums might justly have raised doubts lest the enthusiasm of the searcher for "paleoliths" had gone too far.

The chipped forms were all artificial; but was it fair to call them all "implements," that is, finished tools representing, because finished, the best kind of stone tool that man knew how to make at a given period, and hence his status of culture? Was it fair to assume that man was ignorant of the art of pottery at the time they were chipped, because no pottery was found near them in the washings of floods? When it was asked how, when, and where they were discovered, and who discovered them, the answers were not always satisfactory. Why was it that they could not be found in northern England or Scotland or Scandinavia, beyond the boundary of a supposed area covered by ice at the time they were made, while in the New World they were not uncommon in New England and Canada, north of the same Glacial limit?[1]

The inference that wherever found they were all old, because they looked like Boucher de Perthes' specimens, roused a discussion in America which brought out further doubts, and estab-

[1] The United States National Museum possessed, or has had reported to it by owners and finders in 1888, 8502 of these rude blades (probably all gathered upon the surface or in superficial deposits), of which 218 were found in Maine, 393 in Massachusetts, and 106 in Canada, or 717 north of the great Glacial moraine. See description of the exhibition by the National Museum at Cincinnati in 1888. Proceedings United States National Museum, Vol. XI., Appendix No. 4, page 4.

lished at last a distinction in comparison with which other criteria of age were insignificant. It was that of their stratigraphic position, namely, between (*a*), those found in place in a geolog-

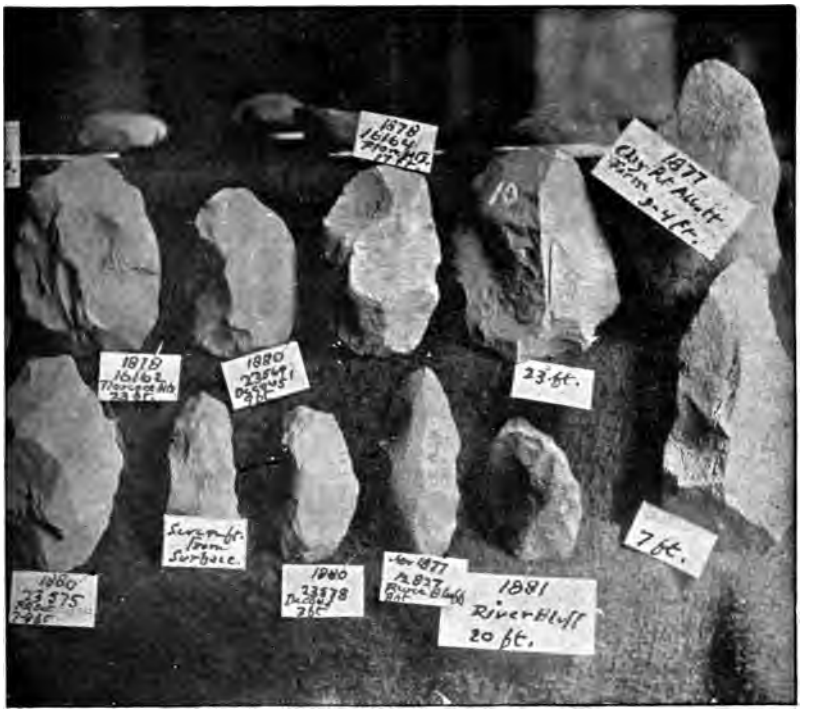


FIG. 2 (× 2/7). — Chipped blades of argillite from the Pleistocene river gravels of Trenton, N.J., said to have been made by Post-Glacial, Pleistocene man on the Delaware beaches at Trenton seven to twelve thousand years ago. From the Abbott collection, Peabody Museum, Cambridge, Massachusetts. (Photographed by kind permission of Professor Putnam and Dr. C. C. Abbott, in September, 1893.) Tickets show catalogued number of specimens, date of discovery, site, depth in Trenton gravels, etc., as stated in the Museum records.

ical stratum that proved their age, and (*b*), those that were found on the surface.

Whatever might be inferred from the shape and finish of the first class, no one has for a long time disputed that in Europe the specimens alleged to belong to it were found in the Drift

gravels with Pleistocene fossils. It was agreed, therefore, that by the lower of the various geological time estimates, they were from seven to fifteen thousand years old. The second, or surface class, however, whether found in the Old World or the New, were not in place. They had no history. They lay on top of the soil where they may have rested for little or much time.

In Europe we were told that blades of this latter class were never found at Dolmens in the Barrows of the Bronze period, or, it was said, in the habitation sites of the age of polished stone; but rather lay scattered upon heaths and flinty slopes or near streams, where they lacked the explanatory association of other human remains. Some European archaeologists, judging by patina, declared that such surface Drift tools had an ochreous color, not present in the later Stone Age specimens scattered with them. Others, impressed by similarity, established with confidence the canon of *type*. The surface specimens were old because identical in type with others that were certainly old. At last, however, explorations in the United States have altered, or should alter, our views as to the class of surface discoveries in general, if they do not modify some of the deductions made from the first class of underground Drift specimens.

Beyond doubt it has been demonstrated in the last five years that North American Indians continually manufactured chipped stones, more or less resembling the Drift types, and in fact scattered the whole surface of the United States with them. Why the fact had not been more clearly noticed before by travellers, who had watched the native North American blade-making process, seems strange, when we consider that it was in the blade-making process that these mysterious, and till then unremarked stones were produced. The Indian blade maker, pounding upon a mass of raw material with a pebble hammerstone, often failed to chip it to the desired shape or thinness. After repeated blows a hump remained in the cross-

grained back that no skill could remove. He threw away the half-fashioned blade to try another stone, and you had in the rejected, half-finished piece a "waster," a "turtleback," a "reject," a "mistake," so much like some of the alleged blades from the Drift that distinction was impossible.

Places were soon found in the United States that were thickly scattered with these "turtlebacks," as New Jersey farmers called them, and in particular aboriginal quarries, where the native stone had been mined by Indians and more or less chipped into blade shape at the spot. The Potomac Valley tribes had, it seems, dug into a deposit of quartzite boulders in the gorge of Piney Branch, near Washington, and sampled and cast aside so great a number of pebbles there that the steep slope was overspread with tons of "turtlebacks" and chips,[1] while the fact of the recent parentage of many of these mysterious stones was further shown when other aboriginal quarries were examined at Flint Ridge, Licking County, Ohio, in Arkansas, in the Indian Territory, and in the Lehigh Hills.

All these "turtleback" sites looked alike. Pits had been dug whose sides were strewn with chips, with the familiar leaf-shaped forms and pebble hammerstones, and at one quarry after another an analysis of the rude blades found, and the

[1] Sometimes the Indians worked on fragments broken from solid veins. Some stones chip better than others, and it was probably because quartzite works badly, and because the material lay in pebble shape at Piney Branch, that there seemed to be more "turtlebacks" to the cubic yard there than at most of the other quarries. Moreover, it was doubtless owing to the uncultivated and still forest-covered condition of the slope that no other Indian tools or relics had been found among the blade refuse at the place, for which reason the site was regarded for some time after Dr. Abbott's discoveries as even a more remarkable witness for primeval man than the Trenton gravels, a Paleolithic workshop, which floods had never disturbed, where Glacial men had chipped their stone blades. But the trenches dug at Piney Branch, by Professor Holmes, though they failed to find positive relics of the Indian among the rubbish, did much to account for the "turtlebacks" and chips as the refuse of modern tribes.

associated remains seemed to connect the work, notwithstanding the "Drift type" of the blades with the comparatively recent Red Man.[1]

By 1892 work enough had been done to relieve our minds as to the class of "turtlebacks" found on the surface in the United States. It was reasonable to suppose that the geologically modern Indian had made, or could have made them all.

To settle this was to realize that a new light had been thrown over the question of ancient blade-chipping, that threatened to cancel many well-known definitions and inferences, if it did not destroy certain established European subdivisions. It had become necessary to discover specimens in place in the United States, while to what extent the same need existed in the Old World no one yet knew. If we were to learn that comparatively modern or Post-Drift peoples had in Europe, as in America, produced rejects or wasters resembling the Drift forms, so that the former might have slipped down from the upper (newer) into the lower (older) horizons, we should encounter the same chance of error there as here ; and in order to settle the question for myself while fresh from a series of parallel comparisons among the wasters at the relatively modern blade quarries in America, I visited the Neolithic (Post-Drift)

[1] At some ancient diggings situated at remote outcrops of the native rock and at spots unfitted for aboriginal habitation, it was as hard to find the grooved axes, arrowheads, or pottery (lacking up to date at Piney Branch) that would have positively connected the sites with the Indian, as it would be to find traces of nineteenth century civilization in the recent rubbish of a modern granite quarry. Nevertheless, at Macungie and Flint Ridge arrowhead-making had gone on, a process held to have been unknown to the Drift man, while the quarrying and chipping was done in jasper, a stone commonly used by Delaware Valley Indians, and which the alleged Paleolithic men were not supposed to have worked at native outcrops. At Durham, a finely polished pestle was picked up in the rubbish. Not only in quarries, but also at Indian village sites, the process of producing "wasters" that resembled Drift "implements" seemed to have proceeded by the same step as where, at an "Indian Field" near Herbine's Mills, in Berks County, Pennsylvania, I found several quartzite chips, "turtlebacks," and hammerstones lying near together.

FIG. 3 (× about ⅙). — Series of unfinished flint blades and "wasters" made by ancient Europeans in the polished Stone Age, illustrating the kind of preliminary work done in producing polished celts, found at the Neolithic quarry at Spiennes (near Mons, Belgium). Examined in March, 1893. — *A*. Results. Long thin blades worked toward a point. — *B*. Results. Chipped celts — round cutting edge specialized. *a*. Blocked out forms tending toward class A. *b*. Blocked out forms tending toward class B. — *C*. Hammerstones and inchoate masses, intent indeterminable, often resembling the ruder forms from Abbeville, American quarry refuse, and Trenton specimens.

Blade quarry at Spiennes (near Mons, Belgium, see Fig. 3), where wasters existed in abundance. There, however, no suspicious confusion or similarity to Drift blades was discovered. The wasters, owing to the peculiar shape of the stone tool (the celt) intended to be made, had, if we were to go by shape, an easily distinguishable look of their own, and were not to be confused with their relatives pulled out of the fossil-bearing Pleistocene gravels at Abbeville, Thetford, and Chelles. Nevertheless, the evidence at a single locality is not sufficient to relieve a large class of so-called "Drift implements" in Europe from suspicion; and until we are satisfied that the polished stone or bronze peoples of the Old World, who continued to use stone blades, never, in the manufacture of these blades produced classes of wasters indistinguishable in shape from the Drift specimens, doubts as to the chances of error in blade gathering must remain, which can only be answered by a search for and examination of a number of demonstrably modern European quarries and blade workshops.

But while quarry hunting, which seems to have received little attention in Europe, may result in bringing reproach upon the whole series of surface found specimens, alleged to be of Pleistocene Age in the Old World, it cannot lessen the antiquity of others which have been found in place.

These demanded our chief attention; and, determined to investigate their story, unbiased by what had been written upon the subject, I visited in 1892 the Drift deposits of Abbeville and Chelles in France, San Isidro in Spain, and Caddington in England, examining the collections of Boucher de Perthes of the Museum of St. Germain and of the British Museum. Then after seeing the collection of Professor Prestwich, I visited that of Mr. W. G. Smith, of Dunstable, England, who together with Mr. F. C. J. Spurrell appeared to me to have thrown most light upon the subject recently. My observations gave the following results.

Two-thirds or three-fourths of the European alleged underground specimens are obtained or bought, as I bought mine at Abbeville and Chelles, from workmen at the quarries.[1] Forgeries

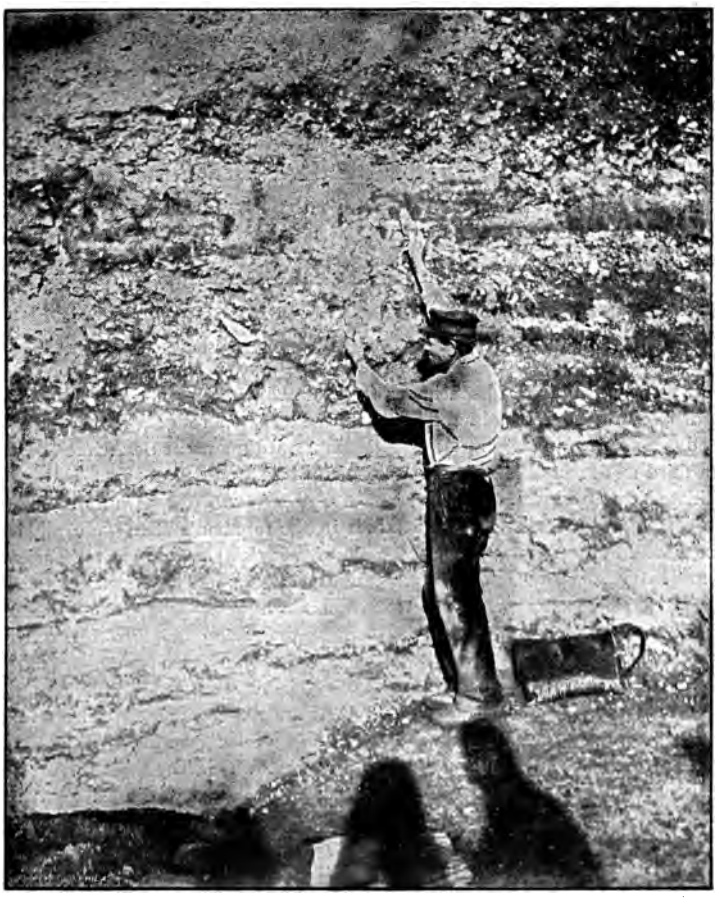


FIG. 4. — Chemin de Poste quarry, Abbeville (upper and oldest terrace), showing the unstratified "Limon rouge" next below surface, resting upon stratified layers. Workman holds "axes" about where he says he found them in the "Limon rouge," December, 1892.

[1] At the Leon quarry, Abbeville, a workman sold me a tooth of *Elephas primigenius* (for 2 francs). Another laborer at the Chemin de Poste quarry sold me

are common. A great number of specimens gathered on the surface upon flinty heaths, or found in superficial or mixed deposits while digging wells, cellars, or ditches are unhesitatingly classed and exhibited with the specimens alleged to have been found in place in the Drift. On the other hand, M. G. d'Ault du Mesnil assured me that he had found many specimens with his own hands *in situ* at Abbeville.

In November and December, 1892, and March, 1893, I carefully examined every cut at the Leon, Chemin de Poste, and Menchecourt quarries, at Abbeville, and afterward searched those at St. Acheul and Chelles, and the Archaeological Museum of the University of Pennsylvania now contains three apparently artificial chips, which I then found in place (see Fig. 1): (1) Museum No. 11,455 with 3 facets on one side, showing the bulb

(for 4 francs) four chipped specimens (2 patinated), and again, three months later, 8 (for 5 francs), found by him, he said, in the "Limon rouge" at the spots indicated (see photograph, figure 1). At the Boulevard quarry at St. Acheul, I bought of a third workman at least a dozen broken "axes" and chips, some of them well patinated, together with the bones of a *Bos primiginius* (for 5 francs). A fourth quarryman, at Chelles, where two tables in the foreman's shed were piled with "axes" and the teeth and bones of the *Rhinoceros tichorinus*, *Elephas primiginius*, *Equus caballus* and reindeer recently found, it was said, and reserved as the property of the company, sold me at his house a number of patinated chips and *coups de poing*, together with three teeth of the *Equus caballus* (for 5 francs). At San Isidro (Rio Mazanares, opposite Madrid) the specimens ("found" by Señors De Prado and Villanova and MM. de Verneul and Cartailhac) which called attention to the site, and later those shown at the École d'Anthropologie, Paris, by the Baron de Baye, indeed all the discoveries save those of M. L. Siret (who says he found a number in place with his own hands, and my own single specimen noticed later) were "obtained," *i.e.*, bought from workmen. At Chelles and Abbeville the collectors and museums had, I learned, followed suit; while at the latter place, my friends, who had cautioned me against forgeries, seemed overtrustful of the gravel diggers when my specimens were bought. I saw a drawer of "fabrications" at the St. Germain Museum, and Boucher de Perthes himself, as I was informed, had been sometimes "fooled." Mr. W. G. Smith says (Man the Primeval Savage, Stanford, London, 1894, p. 295) that a sovereign was often paid at the North London gravel pits (Stoke Newington), and once five pounds for a good forgery. As explained by Mr. Smith in a very interesting chapter, the forgers reproduced the shape, the flaking, the patina (yellow in England, white in France), the quicksilver-like specks, the lustre, and even Glacial scratches.

of percussion, and well worn or worked on the edges, found and photographed in place 1½ meters below the surface at the

FIG. 5. — View of Pleistocene gravel exposure at the Chemin de Poste quarry, Abbeville. Handkerchief shows position of flint chip (Museum No. 11,455) found in the lower part of the "Limon rouge" (upper) layer of gravel, on March 19, 1893.

Chemin de Poste quarry ; (2) Museum No. 11,454, apparently artificial with 6 facets on one side, in place 2½ meters below the

FIG. 6. — Chipped flint blade found in the Pleistocene gravel of the Carreña Sacerdotal quarry at San Isidro, Madrid, Dec. 30, 1892.

surface at the Chemin de Poste quarry ; and (3) Museum No. 11,455½, a thin flake showing the bulb and concentric circles of percussion, at the Leon quarry 2 meters below the surface.

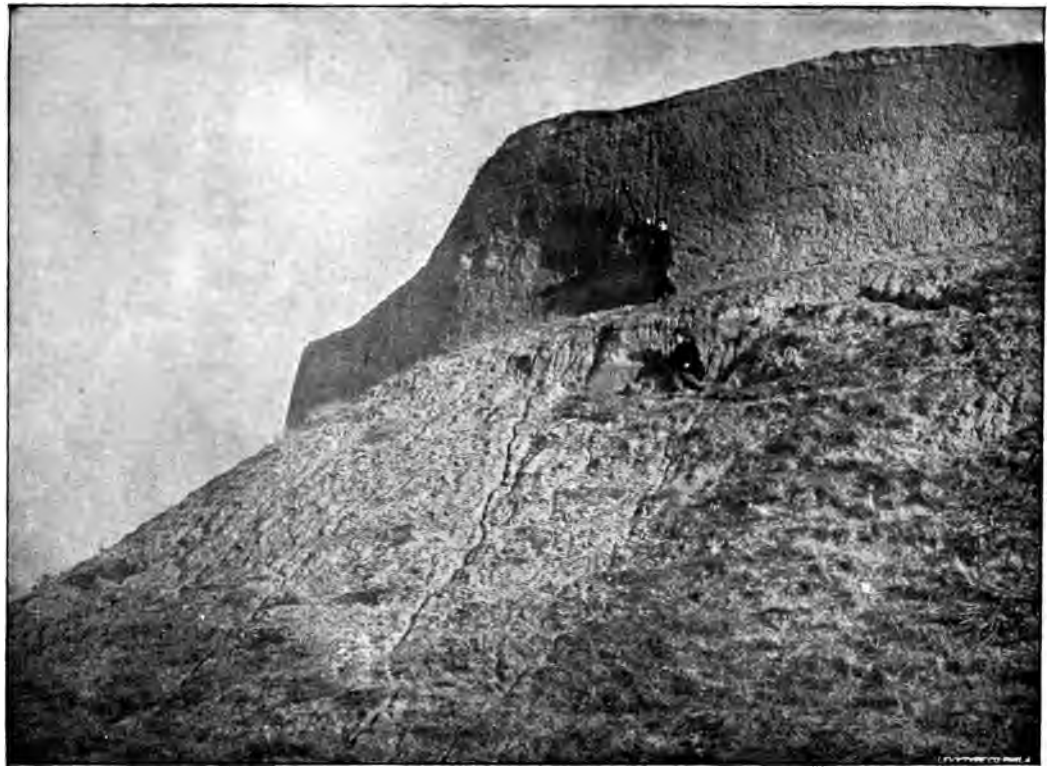


FIG. 7. — View of the Carreña Sacerdotal showing exposure of Pleistocene gravels on the Mazanares River at Madrid (right bank looking down stream). The man points to the chipped flint blade (Fig. 6) replaced in the hole from which I took it an hour before, Dec. 30, 1892.

But the flint nodules of Abbeville flake very easily when struck against each other, and when we realize that the gravel deposits have been "ravined" by streams in past time, that cavities have been formed in the chalk, into which the flints have fallen with more or less suddenness and force, and that the original deposition of the strata must have been accompanied with some jostling of nodules, we need not attribute every flake showing the bulb of percussion to the hand of man.

These specimens, though far more artificial looking than many that have been proved artificial by surrounding circumstances, must therefore be classed as doubtful, and we will not perplex ourselves with an analysis of their position in its exact relation to the unstratified "Limon rouge" and the stratified beds beneath.

At the Carreña Sacerdotal, San Isidro, Madrid, I found on Dec. 30, 1892, and removed with my own hands from the perpendicular face of the exposure, a chipped flint blade of the "turtleback" character, at a depth of 1 meter, 80 centimeters below the surface, which in the desire for extreme exactness as explained in my presentation of the case to the International Congress of Anthropology at Chicago in 1893,[1] I am ready for the present, and until M. Sirets' evidence is in, to place in the doubtful category. But the latter has asserted by letter to the École d'Anthropologie that in the summer of 1892 he found a number of specimens in place at the spot with his own hands. Professor Joseph Prestwich described, in answer to my question, a specimen found by him in place in a freshly cut gravel pit at Amiens, while the recent novel and painstaking investigations of Mr. Worthington G. Smith and Mr. F. C. J. Spurrell at Stoke Newington, London, Crayford, and Caddington, England, are alone sufficient to offset the unfavorable impression caused

[1] The discovery of an artificially flaked flint specimen in the Quarternary gravels of San Isidro, Spain. Memoirs of the International Congress of Anthropology. Chicago, Schulte Publishing Co., 1894.

FIG. 8. — General view of the Pleistocene gravel exposure at the Carreña Sacerdotal, San Isidro, Madrid. Lines of stratification are seen in the perpendicular face of the deposit. The Mazanares River flows on the left. The handkerchief is stuffed in the hole from which the chipped blade (Fig. 6) was taken.

by exhibits of surface-gathered or quarry-bought specimens, and allay the doubts of the American student, who, demanding a revision of the evidence, will take nothing on faith.[1]

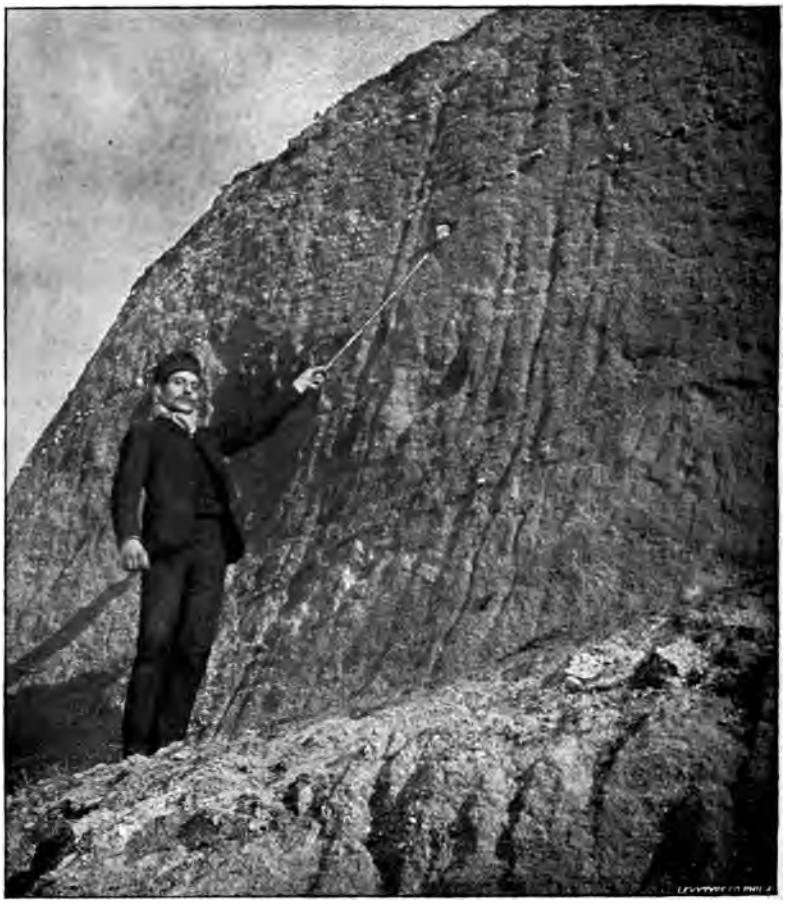


FIG. 9. — Chipped blade resting in its original position in the Pleistocene gravel at the Carreña Sacerdotal, San Isidro. Replaced and photographed within two hours after removal.

[1] Both gentlemen informed me that a very large proportion of their worked blades and chips had been pulled out of the banks with their own hands or before their eyes. (See Man the Primeval Savage, by Worthington G. Smith, Edward

FIG. 10. — Flint blade (Fig. 6) replaced in its original position in the Pleistocene gravel at San Isidro, Dec. 30, 1892, 1 meter, 80 centimeters below the surface.

Stanford, London, 27 Cockspur St., 1894, and, On the Discovery of the Place where Paleolithic Implements were Made at Crayford, by F. C. J. Spurrell, Esq., F.G.S., Quarterly Journal Geological Society, Vol. XXXVI., 1880, p. 544.)

Reasonably satisfied, therefore, as to the Pleistocene Age of the chipped blades found underground in the European Drift (and without here attempting to discuss at length their significance as wasters or finished implements),[1] let us turn to the class of blades found underground in America where the alleged discovery of specimens in Glacial gravels has been called in question at a series of sites of which Trenton is the most important.[2]

[1] Mr. W. G. Smith thinks that some were wasters or unfinished castaways. He calls the majority of the worked pieces, however, "implements," and regards the well-chipped, ovate, and pointed specimens as indicating the best work of their makers. As to which question, judging from signs of use (or water rolling) on many of the specimens in Paris, Abbeville, and the British Museum, and the superior finish of many of the points, I suspect that some were finished implements, and that others may have been cast aside as valueless wasters, or abandoned when partly finished. Mr. J. D. McGuire (American Naturalist, May, 1894. Evolution of the Art of Working in Stone, American Anthropologist, July, 1893) supposes that the European blades are unfinished implements, that the stone workers of the French and English Drift knew how to polish stone, and that the polished specimens, not being needed at blade workshops, would not have been lost and mingled with the refuse in areas like river beaches especially devoted to the chipping process. This theory suggested by Prof. W. H. Holmes (Modern Quarry Refuse and the Paleolithic Theory, Science, Vol. XX., No. 512, p. 295, Nov. 25, 1892; The Archaeologist, Feb., 1893, p. 25) has gathered no support from investigations in Europe and America where more recent blade chippers have not failed to reveal collateral traces of their culture at their quarries or riverside workshops; and notwithstanding the alleged discovery of pottery with Pleistocene fossils in certain European caves (Trou Magrite, La Biche aux Rochers Belgium, Bize, Sauvinargues, etc., France, as asserted by Joly, Dupont, de Puydt, Lohest, and others), the non-appearance of it and polished stone in any of the several well-hunted Drift exposures of England, remarked to me by Messrs. F. C. J. Spurrell, W. G. Smith, and other searchers, is very striking. Mr. McGuire thinks that pottery and bone implements would have been ground to pieces in the Drift; but I saw an egg-shell, said to have been found in Drift gravel, at the Blackmore Museum, Salisbury, England, not to speak of the fragile shells and fossil bones that have survived at many of the pits.

[2] Miss F. E. Babbitt, in 1880, found quartzite, "turtleback" "paleoliths" in what she supposed to be a stratum of Glacial Age under a bluff at Little Falls, Minnesota; but Mr. W. H. Holmes, who cut a trench for forty feet into the bluff on the "turtleback" level, declared that the "turtlebacks" which ceased at about the twentieth foot had slipped down from surface Indian sites, and did not really

Some 500 or 600 rudely worked argillite blades of supposed glacial age, described by Dr. Abbott in Primitive Industry (by Charles C. Abbott, M.D., Salem, Massachusetts, 1881), and in letters written by him to the Peabody Museum, Cambridge,

underlie the true bedding of the bank. A peppering of the neighboring surface soil for a depth of about three feet with artificial chips he ascribed to the settling of the chips into the root areas of trees, uptorn by hurricanes (Vestiges of Early Man in Minnesota, Journal of Geology, April, 1893).

Dr. C. L. Metz said that in October, 1885, he pulled a blade (Peabody Museum, No. 40,970) from an exposed section of glacial gravel at a depth of twenty-five feet on the Little Miami River, at Loveland, Ohio, and another from the bottom of a cistern cut eight feet deep in Glacial gravel at Madisonville, Ohio; but Mr. Holmes, who said he found traces of what appeared to be surface earth, adhering to the first specimen, imagined that it had become reset in a large bank slide, and suggested doubts as to the glacial age of the gravel at the site of the cistern specimen (Traces of Glacial Man in Ohio, Journal of Geology, Vol. I., No. 2, Feb., Mar., 1893). Mr. W. C. Mills said that he found at Newcomer's Town, Ohio, in October, 1889, a chipped blade sixteen feet below the surface in a glacial terrace of the Tuscarawas River; but Mr. Holmes, who found an Indian site with "turtlebacks" on the surface above the exposure, again suspected talus and criticised the statements of Mr. Mills (who had not been aware of the importance of his evidence until several months after the discovery) as those of an untrained observer (Traces of Glacial Man in Ohio, Journal of Geology, Vol. I., No. 2, Feb., Mar., 1893).

Mr. Hillbourne T. Cresson said he found in 1886 a chipped blade in place, eleven feet below the surface and under a large boulder in a Glacial deposit on the White River, at Medora, Jackson County, Indiana, and claimed the discovery about the same time of two other "paleoliths" in place (one of them four feet below the surface) in a still older gravel deposit (Columbia gravel, McGee), exposed imperfectly on the sloping side of a railroad cut near the Delaware River, at Claymont, Delaware. But as neither this evidence, which at Claymont, according to Professor McGee, would multiply human antiquity by ten, twenty, or fifty, nor that, yet more conclusive if true, based on Mr. Cresson's two rockshelters containing "paleolithic" under Indian culture layers, on tributaries of the Delaware, near Claymont, or his mammoth drawing on a shell from the same vicinity, or his aboriginal "pile dwelling" or "fish weir," revealing associated traces of evolution in human culture, on Naamans Creek, Delaware, have been on the whole seriously cited in argument by students, I refrain, after two visits to Claymont, from discussing the almost purely personal question.

Mr. S. Huston says he found in the summer of 1893, at Brilliant (right bank of the Ohio River, ninety miles below Pittsburg), in a Glacial terrace about eight feet down and in place, a triangular-chipped blade, more specialized than most "turtle-

Massachusetts, were found by Dr. Abbott,— when in the employ of the Peabody Museum in 1873, and later, — at Trenton, New Jersey. Some of the specimens were gathered on the surface, others in the Glacial gravel, *i.e.*, firstly, far above high water mark on the face of the high river terrace where the latter was sometimes said to be exposed in its undisturbed bedding by the downfall of sections of the bluff's face; secondly, in inland cellars and wells penetrating the glacial gravel, and where Dr. Abbott said the blades sometimes protruded from the perpendicular face of fresh exposures and sometimes lay in fresh dump heaps; and thirdly, in an extensive railroad ballast gravel pit, fully a half mile from the river, well exposing the stratified gravel deposit behind the town, and where on several occasions the blades were said to have appeared bedded in the vertical face of the cut.

Some of the specimens went to the National Museum at Washington, some to the Natural History Museum of New York, and others to private collections and to Europe; but the

backs," shown by Professor Wright to the American Association for the Advancement of Science at Brooklyn in 1895, where it was declared by Professor Putnam to reveal a patina, indicating antiquity, and by Mr. F. H. Cushing to be a finished "implement" and not a "reject" (see American Naturalist for October, 1895, and Popular Science Monthly for December, 1895). The significance of this specimen has not yet been questioned.

A large class of artificial objects not belonging to the "turtleback" category, found west of the Mississippi, in Pleistocene lacustrine deposits and alleged earlier beds, perplex the enquirer. Pestles and mortars pulled out of the bottom of gold mines, the calaveras skull of superior type yet of alleged pre-neanderthal age, Professor McGee's obsidian spear or knife, whose antiquity was doubted by himself, in the supposed Pleistocene bottom of the fossil Lake Lahontan, Dr. Aughey's spearheads in an old lake bottom near the Missouri River, Professor Cope's similar specimens from Fossil Lake, Oregon, Mr. P. H. Scott's lancehead in a Blue Range Rocky Mountain gravel deposit (see Chap. VI., by Prof. H. W. Haynes, Vol. I., Narrative and Critical History of the United States, Houghton, Mifflin & Co., Boston), have been alleged to represent a "neolithic" stage of culture in "paleolithic" or "pre-paleolithic" times, thus bewildering the student who guesses that man *evolved* in America and developed there through the culture periods named in Europe "paleolithic" and "neolithic."

most important series (of which a description follows) remained at the Peabody Museum, where I visited and examined the Abbott collection of Trenton specimens, on Sept. 20, 21, and 22, 1893.

All data here given (in full when existing) as to the objects (discovered by Dr. C. C. Abbott, when not otherwise stated) are upon the authority of the labels, catalogues, and letter books of the Museum as then seen, from which we learn that four hundred and ninety-six forms are displayed as coming from the glacial gravels. Affixed labels and the catalogue state that 78 of these were found at recorded depths, the greatest depth recorded being 40 feet, the least 3 feet, and the average about 10 feet.

All of the recorded 78 are of blue-black argillite, save 2 of black jasper or chert, 1 of quartzite, and 1 of reddish slate. Several show original water-worn surfaces. But none of the 78, nor, indeed, of the whole 496, are specialized to the extent of the more finely worked French and English specimens.

Not Certainly Artificial.

Eleven would, in my opinion, minus the evidence of associated discoveries, be classed as not demonstrably of human handiwork. This leaves 67 artificially chipped objects with a gravel record, which I would classify as follows:

1. Chips.

There are 7 small worked fragments, or chips, of undeterminate form.

2. Small Disc-like Forms.

There are 5 little rounded shapes, tending rather toward a circular than a lanceolate form, averaging 2 5/16 inches in diameter and 2/3 of an inch thick.

3. "Turtlebacks" Worked on One Side Only.

Of these there are 11 with high "humps" which, though considerably chipped on the converse side, are hardly worked at all on the other.

4. Small "Turtlebacks."

There are 13 of these little specimens averaging about 3¼ inches long, the smallest, No. 10,986, of black chert, 2½ inches long and ⅝ of an inch thick, having been found, says the label, in 1876 at the site of the Lutheran Church, 6 feet below the surface.

5. "Turtlebacks." (See Fig. 2.)

Of these there are 16 of the usual size, generally about 4½ inches long and 1⅜ inches thick. They are rude and irregular, and average about 8 facets apiece on each side.

Among them we remarked No. 11,388, made of a quartzite pebble and showing what seem to be a close series of artificial peckings (after the manner of the pits on a pitted hammerstone) upon its pebble side, found 19 feet below the surface of a river bluff.

No. 44,162, found in a newly dug cellar of the Sixth ward of Trenton, 90 feet from the bluff and about 3 feet down in the gravel.

No. 45,927, of black chert, showing a pebble surface found June, 1888, in a cellar digging in the Chambersburg suburb of Trenton, in place 4 feet down in fine sand below coarse gravel.

No. 11,290, found in a cellar 1 mile east of the river, at a depth of 4 feet.

No. 46,290, found in a sewer in South Warren Street, Trenton, 5 to 7 feet below the surface.

No. 11,539, brought up in a bucket, from a depth of 17 feet in a newly dug well, 1 mile east of the river.

No. 11,291, taken from a wheelbarrow load of wet gravel at cellar digging, 1 mile east of the river.

No. 19,724, from a clay pit on the Abbott farm, 8 feet below the surface.

No. 45,913, from the railroad cut east of the Pennsylvania Railroad station, 7 feet down from the surface.

No. 25,560, found 7 feet deep at the railroad cut, in a pocket of fine sand.

Many others are labeled as discovered at the several river bluffs.

Looked at as a class, these "turtlebacks," with their 13 smaller relatives above noted, are rough, irregular, and very ill mated. Averaging about 8 facets to a side, they betray no systematic style or plan of manufacture, and differ completely from the quarry specimens of Gaddis' Run to be described in the following pages. On the other hand, they resemble in form and finish the patterns hereafter called by us "Riverside Turtlebacks," and discovered at the Indian village sites of Lower Black's Eddy, Gallows Run, Upper Black's Eddy, and Marshalls' Island in the Delaware Valley.

6. Long Thin Forms. (See Fig. 11.)

Four long, thin specimens, of which Nos. 11,529 and 11,287 resemble partly worked blades of the surface cache type, perplex and astonish us; 11,529 is 10½ inches long, 2 inches broad, and ⅝ of an inch thick; 11,287 (a fragment) is 3 inches long, 1½ inches broad, and ⅝ of an inch thick. The former was taken *in situ* from gravel overtopping clay at De Cou's hillside, about 15 feet from the surface, in 1877; and the latter, found in March, 1877, beneath sod against A. K. Rowan's bluff, 22 feet from the surface, was so placed as to give evidence

of not having fallen from above, though its resemblance to Indian specimens was noted at its discovery.

Numbers 10,188, 5 1/16 inches long, 1½ inches broad, and only ½ of an inch thick, and 10,189, rough and clumsily splin-

FIG. 11 (× about ½). — Long, thin forms recorded at the Peabody Museum as found at stated depths in the Trenton gravel.

tered, 4 inches long, 1¼ inches wide, and ⅝ of an inch thick, were, say the labels, found in place in gravel 4 feet from surface on the Lamberton Street bluff, by F. W. P. and C. C. A.; but the excavations, hereafter described at Lower Black's Eddy, show that Indians in geologically modern times made blades like these.

7. Specimens Resembling the Rude Based "Coup De Poing" of Abbeville. (See Fig. 12.)

We seem to be at Abbeville again as we handle the 3 interesting specimens, No. 11,752 (found 1877, 7 feet from surface on the bluff), No. 16,161 (found 1878, at railroad cut,

No. 16,161. 4 feet from surface, R. R. cut, 1878. | No. 11,752. Gravel of Trenton bluff, 7 feet. | No. 45,913. R. R. cut, 7 feet. May, 1888.

Fig. 12 (× ½). — Three Trenton specimens (Abbott collection, Peabody Museum, Cambridge, Massachusetts), rude at base and worked to points, resembling (though lacking the specialization of the latter) the rough based pointed forms from Europe (see Fig. 1). The labels on the margin give the Museum record.

1 mile east of Trenton, 4 feet below surface), and No. 45,913 (found May, 1888, at the railroad cut, 7 feet from surface). These certainly have been roughly worked down to points, leaving the base comparatively untouched, after the manner of so many of the eye-catching European specimens, yet quite

lacking the degree of specialization at the point that characterizes the best make of those latter. Three other specimens of this shape, Nos. 16,325, 12,281, and 33,367, seem still better adapted for grasping in the hand as tools, but their depth and position have not been recorded.

Well would it be for the argument by shape in America, if there were more of these European-looking hand-picks, if we may call them so, in the Trenton list. But the three with a record fail to give character to the American series. The most prominent, perhaps the most finished type in Europe is absent (with these three exceptions at Trenton) in America, and when we realize this, we see that the alleged resemblance between the American and foreign specimens is not so strong after all.

8. "Turtlebacks" of Indian Quarry Type. (See Fig. 13.)

A group of 4 "turtlebacks" (15 others like them lie near them, of unrecorded depth and position) have seemed to other eyes, as to ours, a class by themselves, for they have been ranged together in rows and catch the eye at once as we overlook the collection.

While the other "turtlebacks" are rough, thick, ill-mated, and many planed, these are broad, clean cut, regular, thin, and of few planes. They average about 6½ inches long, 3⅓ inches wide, and 1 inch thick, with about 3 facets (4 at most) to a side. One, No. 33,168, was found October 3, 1883, at the railroad cut, 9 feet below the surface; and 3, Nos. 41,089, 41,098, and 41,100, on Tuesday, March 8, on De Cou's bluff, touching each other as they protruded from a break in the escarpment, 5½ feet below the surface, and where the bluff top was 60 feet above the river. The other 15, as noted above, are from undetermined positions, and 2, notwithstanding their case labels, should by the catalogue be classed

as Indian specimens. To look at the 4 and their 15 fellows is to stand again at the quarry at Gaddis' Run, described in the following pages. They are a class by themselves, and without venturing to call them "quarry turtlebacks," we see clearly that they bear a striking and undeniable resemblance to the

FIG. 13 (× about ⅓). — "Turtlebacks" of the Indian quarry type from Trenton. The museum record states the depth at which four were found in the gravels. Compare with Fig. 23.

list presented later, exhumed from the Indian diggings at Gaddis' Run.

To sum up, the collection shows 61 Trenton specimens with a gravel record, 41 of which hail from one or the other of the river bluffs, and 19 from inland cellars and railroad cuts. Four will be shown to have the mark of an Indian quarry strongly upon them, 3 have the look of partly finished Indian cache blades, 3 are pointed and with their blunt bases have the marked

European character of the *coup de poing*, though by no means specialized up to good examples of the class in Europe, and 29, while they resemble in form the unspecialized shapes from the French and English gravels, are indistinguishable in appearance from the Indian specimens found at Indian village sites on the Delaware, and which we propose to call "Riverside Turtlebacks."

As a class unaccompanied by hammerstones, they are certainly ill matched, irregular, and perplexing. If they furnished some one specialized form like the best of the well-worked Chellean oval blades of France, we might hold fast to it as a type; but they do not. If they showed signs of use, which not one of them can be said to do, we would hold a valuable clue to the purpose of their manufacture. Nevertheless the evidence as to their significance sufficed to satisfy a number of observers at the start, and that these blades were the handiwork of a primitive savage, who chipped them on the cold Delaware shores seven to ten thousand years ago, soon came to be the general opinion of men of science.

Professor N. S. Shaler, visiting the spot (Peabody Museum Report II., 45) agreed with Dr. Abbott that the blades came from undisturbed Glacial gravel.

Professor F. W. Putnam (Proc. Bost. Soc. of Nat. Hist., Jan. 19, 1880) supposed he had found a blade in place, though afterwards, in a verbal address (at the meeting of the American Association for the advancement of Science at Madison, Wis.), seemed to lack positive assurance of the undisturbed position of the object. Professor G. F. Wright, Mr. Lucien Carr, and Professor H. C. Lewis, having visited the place, admitted the correctness of the observations, though the latter afterwards changed his mind, as did later Professor W. Boyd Dawkins, who had also been to Trenton and become satisfied. Professor Morse and Professor H. W. Haynes both found specimens and were convinced, though the latter informed me in

1895 that his blades had come from the talus. On the other hand, Professor Joseph Leidy never admitted the significance of the discoveries, to the list of which three human skulls, a human jaw, a mastodon tooth (Mortillet Materieux, XVIII., 334), and an antler knife-handle had been added, while Mr. W. H. Holmes produced a sensation in 1893 by challenging the whole question (Journal of Geology, Vol. I., No. 1), alleging after examination of the Trenton gravels —

a) That the blades found on the bluff were not in place, but in talus, since none could be found in a fresh sewer trench which penetrated the bluff inside of the talus line.

b) That the other blades from the railroad cuts and cellars were not found as alleged.

c) That the Trenton blades were not only not true gravel implements as alleged, but not "implements" at all. They were the wasters or rejects cast away as explained above, by modern Indians whose village sites occupied the surface above the gravel. To this Dr. Abbott answered:

a) That the deep dark sewer trench, whose sides were often obscured by planking, and whose exposed stones were caked in yellow mud, was so ill adapted for the discovery of blades that the failure to find them there was not conclusive.

b) That the evidence for the cellars and railroad quarry had not been fairly met.

c) That the blades were not modern Indian wasters and did not truly resemble them.

The discussion that followed, involving questions of veracity and faithfulness of observation on both sides, soon took a very personal turn, rather than participate in which, it seemed better to the writer to reëxamine the Trenton pits and push forward investigation at other points in the Delaware Valley in the hope of finding traces of Paleolithic man (if he existed) elsewhere in the region, and finally demonstrating the truth, which, whatever it was, could not remain indefinitely hidden.

The results of a series of explorations in the Delaware region were as follows:

1. Three personal searches at the Pennsylvania Railroad ballast quarry at Trenton, the site of numerous discoveries, and where the stratified gravel was continually exposed by the workmen in fresh sections, failed to reveal a specimen in place.

2. Argillite "turtlebacks" resembling the Trenton blades were found associated with Indian refuse at Gallows Run, Hickory Run, Lower Black's Eddy, and other river village sites, and never at isolated spots or flaking places disassociated with Indian remains.

3. Indian quarries were discovered in the adjacent region at Durham, Saucon Creek, Macungie, and Vera Cruz, where Indians had mined jasper in comparatively modern times, and produced wasters, "turtlebacks," resembling in all but their material the argillite "turtlebacks" from Trenton, and their duplicates from the surface river village sites.

4. As compared with Europe, the traces of man in the Delaware Valley (if we except Trenton) were modern and scanty. The thin homogeneous deposits were all referable to the Indian, as we know him.

5. The caves explored by the writer failed to give conclusive evidence of pre-Indian or geologically ancient man, Durham Cave having been injured by blasting before examination, Hartman's Cave having been excavated without a careful study of layers, Raubsville Cave having lacked floor deposits, and the "Indian House," with its floor film of Indian refuse, having appeared of insignificant size.[1]

[1] Mr. H. T. Cresson's two caves near Claymont, Delaware, referred to above, on small river tributaries, alleged to have contained layers representing Paleolithic man with the superposed rubbish of intermediate peoples, and lastly the Indian, have been eliminated from the discussion by the writer on the strength of doubts current at Claymont and elsewhere as to the accuracy of the observations. The floor of Dr. Haldeman's Rock shelter at Chickies, on the lower Susquehanna, was excavated without reference to layers, if more than one existed.

Such in general was the state of the question in the spring of 1893, when a renewed search for the source of the raw material argillite, of which the Trenton blades were fashioned, resulted in an observation which promised to throw new light on the situation.

CHAPTER II.

An Ancient Argillite Quarry and Blade Workshop on the Delaware River.

Of considerable importance to Archaeology was the discovery on May the 22d, 1893, of a series of nineteen of the now familiar ancient pits, surrounded by masses of argillite chips, a

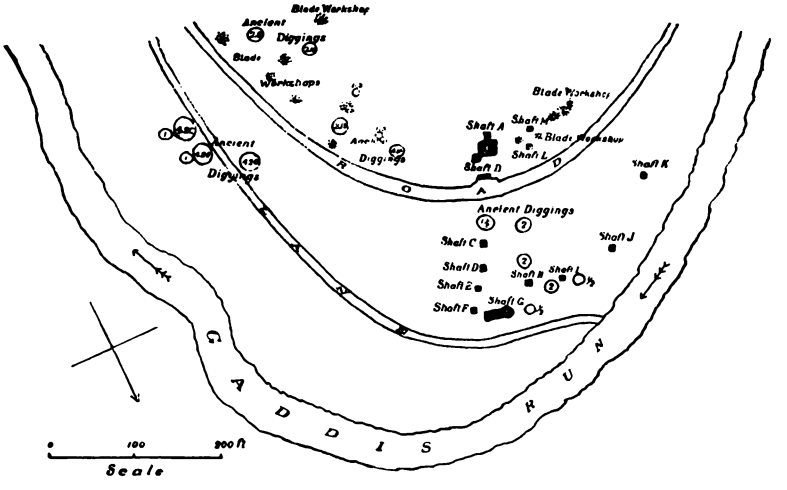


Fig. 14. — Rough map showing the position of the ancient diggings, blade work-shops, and our trenches at Gaddis' Run. The circles represent the pits. the first numeral inside them standing for their depth, the second for their diameter. The black rectangles mark our trenches.

quarry, in fact, once worked by aboriginal peoples in the Stone Age, with all the surface characteristics of Macungie, Vera Cruz, and Durham in America, or Grimes' Graves or Spiennes in Europe. The diggings skirted the steep north slope of the hillside at Point Pleasant, Bucks County, Pennsylvania, on

the right bank of Gaddis' Run, about one-quarter of a mile above its mouth and half a mile from the well-known Indian camp site at Lower Black's Eddy (see Fig. 25), and the study of the place seemed desirable, because

a) These quarries, unlike the jasper mines in the Delaware Valley, recently proved to be the work of modern Indians, were workings by some ancient people in argillite (metamorphosed slate with conchoidal fracture), the same stone with which various observers assert that man living on the lower Delaware, at the time of the melting of the great glacier, made his rude implements ; because

b) Granting that Glacial man, obtaining his material either at this first outcrop of the rock on the right river bank above his habitat,[1] or from erratic ice-born masses in the river bed, chipped argillite implements at Trenton seven to ten thousand years ago,[2] we might here have had reason to modify previously received views concerning his status of culture, as we learned whether the quarries were his work or the work of the comparatively modern Indian, of a stone chipper ignorant of the art of stone polishing (Paleolithic man), or of a stone chipper who could also polish stone (Neolithic man); and because

c) The quarries, if the work of the Neolithic Indian as known to white men, might have shown us to what extent the use of argillite was continued into recent times, and whether, as at

[1] On Dark Hollow Run (below New Hope) I found a small vein of it nearly two miles from the river. The blue slate in Pidcock's Creek, on the south slope of Bowman's Hill, and at the Harvey and Van Hart quarries below Taylorsville, lacks the conchoidal fracture. During the present work a small outcrop of good argillite with similar evidences of quarry work by ancient blade makers, was discovered on the left bank of Neshaminy Creek, about half a mile above the mouth of Mill or Lahaska Creek. The Gaddis' Run vein extends across the Delaware and is clearly exposed at Byram, on the left bank, opposite Point Pleasant.

[2] Since this was written, Professor J. W. Spencer (see The Duration of Niagara Falls and the History of the Great Lakes. New York, Humboldt Publishing Co., 1895) estimates the antiquity of the Niagara gorge at 32,000 years, thus venturing to quadruple the antiquity of the Glacial period, and hence of the Trenton gravels and any human remains that might exist in them.

the Jasper quarries of Durham, Vera Cruz, Macungie, and Saucon Creek, the chipped refuse was scattered with "wasters"

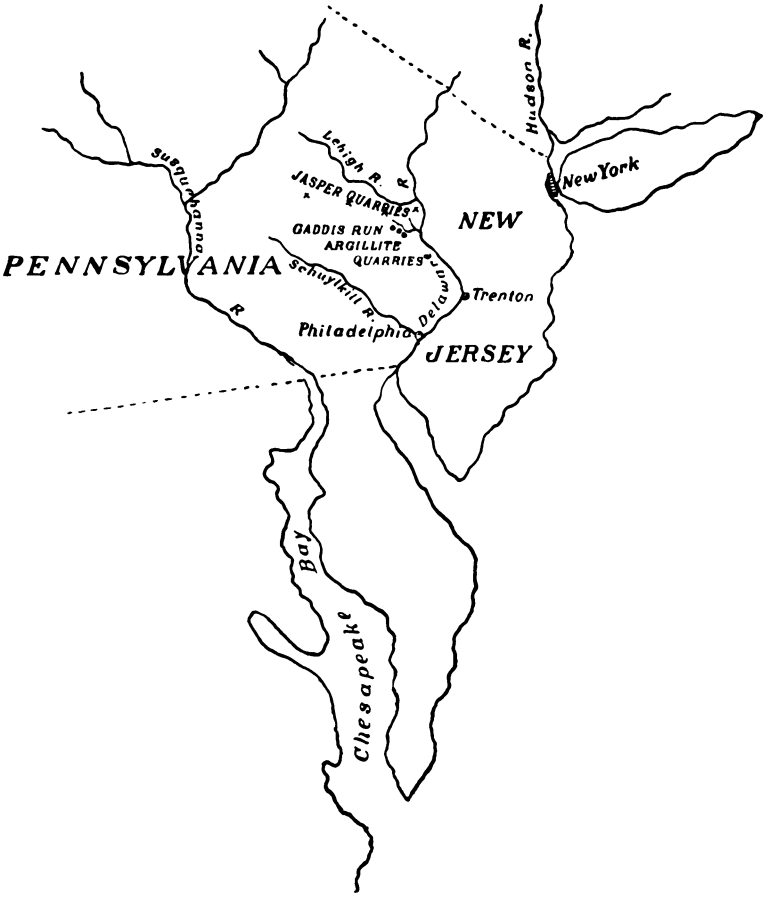


FIG. 15. — Map showing the relative position of the ancient argillite quarries at Gaddis' Run.

or blocked out blades, resembling in form the supposed more ancient specimens of the same material found at Trenton.

The ancient excavations notched in the slope, whose general angle was about thirty-five degrees, fronted a solid vein of

argillite, here traversed and exposed by Gaddis' Run, and twice tapped near at hand by modern curbstone quarries as the purest source of the material. The surface rock through which the Delaware and the neighboring streams had cut their way was part of what is known as the "New Red Sandstone" (popularly "red shale or slate"), formed by processes of submarine hardening in Mesozoic time, when the whole seaboard, from the Lehigh Hills to the Atlantic, lay under the shoaling waters of a marsh-fringed ocean. Generally of a dull red color and straight fracture, this slaty crust, extending over a large part of Bucks County, has been in several places burst through by igneous masses, resulting in the piling up of heaps of eruptive boulders, notably those known as "Jericho Hill," "Bowman's Hill," and "The Haycock."

At Gaddis' Run and at other points, the contact of the molten rock from below — the Trap — has, it is said (though geologists are not fully agreed upon the point), produced the argillite in question by "baking" the neighboring crust of shale and thereby changing its red color to a bluish black, and its straight fracture into a beautiful conchoid.[1]

We had noted that we were twenty-five miles above Trenton, and, as stated above, at the only out-crop of true argillite on the right river bank above that place. (See Fig. 15.) The bed of Gaddis' Run and the river shore below its mouth were thickly strewn with argillite blocks and water-worn boulders, — a pathway, so to speak, littered with blade material extending from the ledge laid bare by the stream to the Indian camp

[1] Sometimes, as on the top of the Gaddis' Run Hill, we seem to stand on the edge of a crater of an extinct volcano. On the one hand lie about us large masses of the erupted Trap (vulgarly called "Iron Stone" and "Mundock"), which frost and weather are seen changing from angular into globular masses by a curious scaling process that resembles the peeling of an onion. On the other, thickly mixed with the Trap boulders, lie softer fragments of blue baked shale or argillite. With the two we find unclassifiable specimens that seem neither one rock nor the other, — edges, possibly, of the crater, that tumbling into the hot outburst had been cooked over in the Trap pudding.

above mentioned, half a mile distant on the river. (See Fig. 25.) While the significance of this fact had been obscured by chipped fragments from the modern quarries fallen into the stream, and the stone dressing that had accompanied the building of a dam, two bridges, and a canal aqueduct, there could be little doubt that the inhabitants of the village often went no further than a few hundred yards along these beaches for their material.

Ascending the hill and following the banks of "Hickory Run" (a brook that descends its slope to fall into the Delaware a few hundred yards below the mouth of Gaddis' Run), I had found two years before a series of Indian camp sites, containing unmistakable traces of Neolithic occupancy, notably a work-shop, where several "turtlebacks" lay scattered, with chips and a few rude spear or knife points of argillite. At the latter spot, scarcely a mile from the quarries, a few Jasper flakes were also found, and quartzite pebble hammerstones were frequent; but these, I learned from inhabitants, strewed the whole hill above and beyond the ancient mines.

A mill, destroyed by a freshet about 1860,[1] and a house and barn removed since that time, had stood along Gaddis' Run between the highest and lowest excavations. A turnpike road and a lane skirting the ravine had cut through the quarried area, destroying several of the pits. (See Fig. 14.) One of them had been cleaned out by a recent would-be discoverer of a mine of metal. Near the mill site a band of negro refugees had encamped since the war of the rebellion. But in spite of these facts the wild ravine slope, never cleared of its original

[1] Popularly called the "Thundergust Mill," because in the later days of its existence Gaddis' Run, save after a storm, lacked the water to run it. Mr. Andrew Schwartz of Point Pleasant told me that when his father had bought "Thundergust Mill," about eighty years ago, there had been water enough to run the wheel eight months in the year. Modern freshets in the ravine were in his memory much more sudden and higher, though the stream, since the cutting of the Plumstead forests, had diminished into a rivulet half hidden among stones.

FIG. 16. — Face of shaft A looking East, showing the undisturbed refuse of the ancient quarrymen. Argillite chips, quartzite pebble hammerstones, and "turtlebacks" lying together in their original positions.

timber, and too steep and rocky for cultivation, had not been seriously disturbed by civilization. No one had noticed the chips or guessed the meaning of the holes.

With this much preliminary information we were prepared to begin extensive digging at shaft G (see Fig. 14), by the stream, and at shaft A, 299 feet above it, where one of the old pits cut in the slope whose angle was about forty degrees, ended abruptly against a solid ledge of argillite. Here, if anywhere, it seemed we might learn how, when, and for what purpose the work, as to which history and tradition gave no clue, was done.

At both shafts the surface was bedded with artificial chips, over which in many places grass had not grown. At shaft A, near a quartzite pebble showing no signs of battering, lay a rude lanceolate form of chipped argillite (a "turtleback"), while at G, bedded in the chips and close to another "turtleback," lay a well-worn, quartzite pebble hammerstone with the familiar pecked sides. The surface chips at A and G, heavy and often showing the bulb of percussion, were instantly distinguishable from the thin and knife-like ones afterwards noted at the river-side workshop sites. Several larger masses of argillite lay among them.

As the workmen went down, the conditions continued the same at both places. Through the thick mass of chips (see Fig. 16), often scarcely mixed with earth at all, were scattered numerous quartzite pebbles well bruised by use as hammers, rudely made "turtlebacks," and bits of charcoal. Here and there were larger chipped masses, and underlying all at A on the solid ledge large disturbed blocks weighing several tons. (See Fig. 18.)

Having reached the bottom of the old digging at A at a depth of nine feet, we went onward until the sides of the confronting ledge showing no sign of work were laid bare. Then the bed of chips was cut through twenty or more feet to the right, until our shaft A measured about 2148 cubic feet, with G at about 787, and until our gathered mass of information, reinforced by the evidence of eleven other pits and trenches —

B, C, D, E, F, H, I, J, K, L, and M (see Fig. 14) — satisfied us that the ancient work was homogeneous throughout; that the hammerstones and "turtlebacks," of the surface resembled those at all depths; that there were no layers indicating different epochs; that the same people who had left the pitted hammerstone and "turtleback" resting on a heap of chips at G had done all the work.

The results of our excavation, continued for nine days, may be summed up under the following heads.

Digging Implements.

There were no digging implements found, and none it seems would have been needed. Undoubtedly the whole hillside at the point of disturbance, as is still the case elsewhere, had been originally thickly covered with loose argillite fragments weathered from the ledge. These had been pulled out by hand, worked as required, and thrown behind the workman. Judged by a line of pits sunk by us from A down to the stream, it seemed that at the water's edge, where an ancient explorer would first have encountered the pure ledge, the quarrymen beginning at the bottom had worked up hill, leaving an excavated hollow ahead until the perpendicular ledge was reached. Here the last hole left, as was the case at A, would have been partly filled by downsliding earth and stones from above.[1]

[1] The surface conditions being the same at most of the pits, it seemed fair to consider that some artificial underground disturbance continued over an area of about three acres. To what depth, however, only the sinking of dozens of shafts could have proved. To presume that the disturbance indicated by all the nineteen depressions was the same as all those studied (*i.e.*, fully thirty times their cubic contents), and that therefore 14,070 cubic feet of stone was overturned and worked by the ancient quarrymen, is only guessing.

Pottery.

A small glazed potsherd fell out of the first three or four loose shovelfuls at G ; but occurring thus close to the surface, not one hundred yards from the site of the old barn, and unsupported by any further evidence of the sort, it could not fairly be counted with the refuse in which we found it. No other trace of glazed or Indian pottery was found anywhere in the quarries.

Fire Sites.

We came upon four masses of charcoal and ashes about two inches thick and eighteen in diameter, — in shaft A, at depths of eighteen inches, three feet, and seven feet, respectively, and in shaft G, at a depth of one foot ; but not one of these fire sites, save in its position, revealed the slightest trace of human intervention.

M. Cornet found a fire site with potsherds deep down in the refuse at the Spiennes quarry in Belgium ; Canon Greenwell found a hearth in one of the pits at Grimes' Graves, Suffolk, England ; Mr. Holmes found the novaculite ledge at the ancient quarry in Garland County, Arkansas, distinctly splintered by fires ; and I saw jasper blocks arranged in an oven-like cavity at the ancient jasper mine at Macungie, Lehigh County, Pennsylvania, for the purpose of fracturing or coloring the stone by fire ; but here the condition of the fire places offered no suggestion of their use.

Bits of charcoal lay scattered through the chipped mass, but not thickly, as in the jasper mines.[1] They might easily have

[1] The ancient jasper mines referred to in this paper are those discovered by Mr. Charles Laubach, Mr. A. F. Berlin, and myself, in 1891–92, at Durham, Limeport, Saucon Creek, Vera Cruz, Macungie, Long Swamp, Feuersteinburg, and Leimbach's Mills, in Bucks, Lehigh, and Berks Counties, Pennsylvania, and examined by me for the University of Pennsylvania last October. An account of the work has been published in Popular Science Monthly for Sept., 1893, and American Anthropologist for Jan., 1894.

worked down from the fire places observed and others that had doubtless been overturned in the moving of the blocks. If fire had been continually used in any unsuspected part of the mining process, the charcoal would have been more frequent. If heat had been employed to shiver large masses of stone, then the latter would have shown signs of scorching, or sometimes have lain diagonally above or against the fire sites, as in one instance at Macungie. But such was never the case.

In my experience heating an argillite block in an open fire made it much more easy to break, but seemed to coarsen the grain. Though I made several "turtlebacks" of the baked stone that equalled my efforts with the unbaked, I noticed a difference, and question whether the former would have worked with the thin blades afterwards found at the Indian camp sites.

Among the refuse lay plenty of good fragments of a size easily breakable with hammerstones, without needing to resort to large intractable masses where fire would have helped. But the fact that only one fire site was at a depth where these heavy blocks were common, and the fact that some of the stones were pecked on their sides as if to split, added sufficiently to the burden of proof that heat was not employed to break them, and left the reasonable inference that the fires had been built to warm the quarrymen at what must have been cold work in winter.

Bones.

In A a small bone was found at a depth of about three feet, and in G another at a depth of one and a half feet. Neither have yet been identified. Both lay near cavities inhabited by ground squirrels and large enough for the entrance of foxes and other animals, and therefore can, until identification, have little significance.

Large Worked Masses.

As before remarked, the loose masses of argillite grew larger as we went deeper. Why so many of them, still easily breakable with hammerstones, and containing many cubic feet

Fig. 17. — Large block of argillite found at a depth of 5½ feet in shaft A, worked by the aboriginal quarrymen as if to split with the grain.

of blade material, had been passed over, remained an unsolved problem to the last.

At A, directly on an upper step of the ledge, at a depth of 5½ feet, lay a block weighing about 150 pounds (see Fig. 17), deeply marked with a line of peckings on its side, on a plane that would have split it with the grain. There were four smaller pieces, at depths of one, five, and three feet, weighing about seventy pounds apiece, perceptibly nicked near their fractured sides, as if the marks had been made in splitting them. But

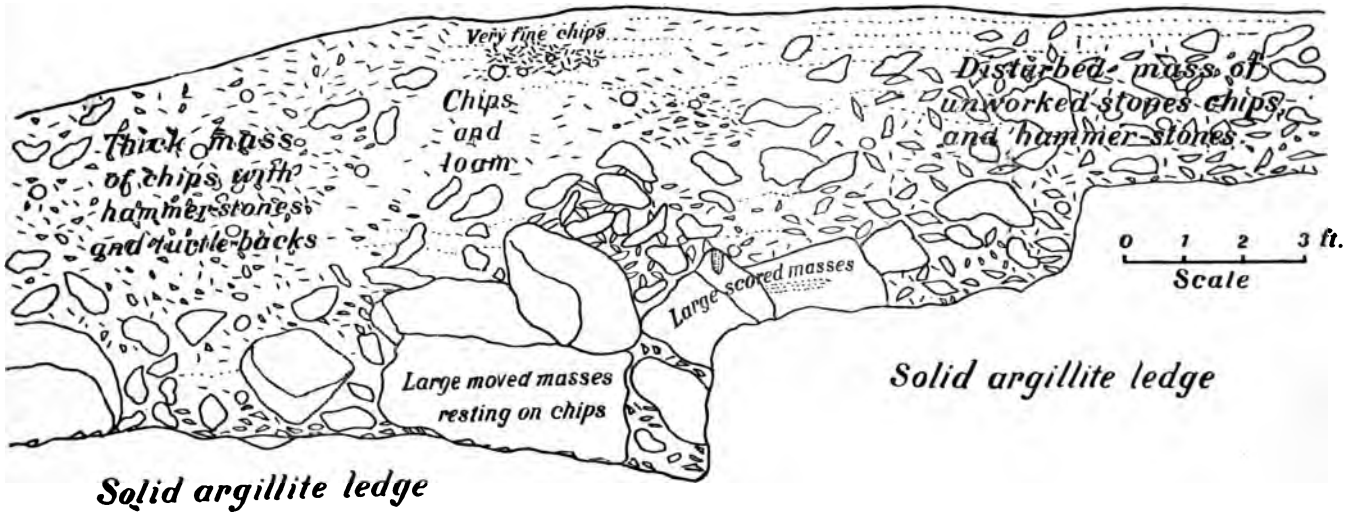


FIG. 18. — Face of shaft A looking East, showing the general character and position of the rejected stones and blade refuse left by the ancient quarrymen.

a much larger block, weighing several tons, had been indented at several points on its side in a different manner. Besides several deep scratches, there was what might have been called a heavy scrape, as if in managing the block with heavy wooden levers (like those found at Macungie), a hard stone had been ground upon at the point of leverage or under the mass.

That these large blocks had been moved from their original positions, either by undermining, when they would have fallen downward, or by trees used as levers, was again proved by a still heavier mass (see Fig. 18), lying at a depth of seven feet on the level ledge at A, for a number of chips lay exactly under it. As remarked before, fire had evidently not been used, either to break these formidable masses or to cut into the solid ledge below them.

Flakes.

It was these that first caught the eye at the quarries. Save in shaft A, close to the ledge, where they were sometimes interbedded with layers of clay, they formed, as before mentioned, a dense mass almost free of soil. (See Fig. 16.)

The average flake weighed three to six ounces ; one of the largest, eight pounds. In shaft A there were two bands of finer chips about one-eighth of an inch in diameter, yet possessing the same character and proportion. Many showed the bulb of percussion, and all were thick for their length (see Fig. 16), and in sharp distinction to the very thin flat ones and long knife-like scales (see Fig. 24) afterward excavated at two Indian riverside flaking sites. However these latter were produced, the quarry chips were evidently made by blows. I had no trouble in reproducing them on the spot with the pebble hammers found, but a careful and continual comparison of them with the Indian flaking site, to be described later, forced on me a full realization of the fact that the quarry and Indian

workshop exemplified processes of argillite blade-making, distinct, special, and each an art in itself. Whatever the method of the workshop, — and experiment failed to explain it, — that of the quarry was *blade-chipping by percussion with stone hammers*.

Hammerstones.

All the 174 hammerstones found were water-worn pebbles, generally slightly modified by pounding. Nearly all were of

Fig. 19 (× ⅙). — Quartzite pebble hammerstones found in shafts A and G.

quartzite, or trap, a dozen or more of white quartz and hard sandstone. Careful search might have discovered a few like them among the slate and argillite fragments in the stream bed near at hand; but as thousands of pebbles scattered the river beaches half a mile away, it was necessary to conclude that most of the quarry specimens had been brought thence.

None were regularly discoidal like many of the hammerstones at the jasper quarries of Durham and Macungie, nearly all being so irregular in shape as almost to argue that round pebbles, easily enough found if wanted, had been eschewed by the hammer gatherers. (See Fig. 19.)

The largest hammer discovered weighed 4 pounds, 13½ ounces, the smallest 1½ ounces, and the whole series seemed divisible according to size and weight into four groups : (*a*) 8 specimens, averaging 4½ pounds in weight ; (*b*) 19, averaging 2 pounds, 3 ounces ; (*c*) 126, averaging 18 ounces ; and (*d*) 21, averaging 3 ounces. The group of 21 little ones showed no signs of use, yet being of the smallest size, the light blows struck by them would have availed least to abraid their tough sides. There was no mark of a groove or trace of hafting on any one of the whole series ; but that they had been used to make the "turtlebacks," there could be no question. The frequent occurrence of beds of chips, in which they and the latter lay within a few inches of each other, proved it beyond a doubt.

In carefully gathering and recording every pebble seen, a noteworthy discovery was made. Three of them had the familiar pitted hollows upon their sides. (See Fig. 20.)

I have as yet heard of no pitted hammerstone found beneath the surface, at any ancient American quarry, and fail thus far to see how they could have been connected with the work done at any of the similar sites examined by me. Yet here were three distinctly associated with what appeared to be solely a process of *flaking by percussion*.

If these specimens had played some unsuspected part in the work, then we should have found more of them ; but 3 out of 174 is so small a proportion as to rule them out of such consideration, and force us to believe that they were brought there after having served their purpose elsewhere.

Here, then, was a clue. The quarryman had dropped some-

thing to tell whence and what he was, and the state of culture represented by the quarries was that denoted by the pitted hammers.

When, however, we ask what was the cultural significance

FIG. 20 (× ⅜). — Three pitted hammerstones resembling the familiar Indian specimens. Two of them were found beneath the surface in the refuse.

of the pitted stone hammer, we ask a question whose study carries us from the New World to the Old, and backward from the dawn of history into prehistoric time.

In eastern Pennsylvania we can, however, begin by saying that the implement is a universal token of the past presence of the Indian. Every village site in the Delaware and Susquehanna Valleys that I have examined has been only less plenti-

fully supplied with its patterns, than with the unpitted bruised pebbles mentioned above. Exactly what was its use in North America had been greatly a matter of inference until, a few years ago, Mr. J. D. McGuire, of Baltimore, discarding all theories of "paint mortars" and "nut crackers," produced with it in diorite and other hard rocks several finely pecked axes that would have done credit to the workmanship of an Indian. As a battering tool, held, as he held it, by the pits, between thumb and second finger, so as to strike about 200 springing blows to the minute, he argues (The Stone Hammer and Its Various Uses, American Anthropologist, November, 1891) that by its aid all carved specimens of the Stone Age throughout the world were fashioned.[1]

The rarity, however, of pitted hammerstones in regions where stone was extensively carved in prehistoric times is strongly against his theory,[2] while sometimes pittings on pebbles can be accounted for in other ways. Caleb Lyon (Bulletin N. Y. Ethnological Soc., Vol. I., p. 39) saw Shasta Indians in California, about 1860, splitting obsidian pebbles for arrowhead-making on stone anvils of compact slate held on their knees, as Schoolcraft (Indian Tribes, Vol. III., p. 467) saw jasper lumps shivered for flakes on similiarly held basal stones; and it seems probable, from a series of sixty-seven "pitted hammers" collected by me from fifteen camp sites[3] in the Delaware Valley, that some of these scored

[1] See, also, for his recent very interesting argument that man was a stone batterer and polisher (Neolithic) before he became a stone chipper, and that the "Paleolithic" status of culture as now understood never existed, the American Anthropologist for July, 1893.

[2] I could hear of none in Yucatan and failed to find signs of any at an ancient stone dressing site in the northern part of the Peninsula. See Hill Caves of Yucatan, Lippincott, Philadelphia, 1895, page 74.

[3] On the Delaware, at Gallows Run, Gilmer's Island, Upper Black's Eddy, Lower Black's Eddy, and at Paul's Valley, North Branch, Roberts farm (Neshaminy), Graeme Park, Dark Hollow, Panabussing, Cook's Run (Neshaminy), Bartleman farm (Hickory Run), Magill farm (Carversville), Mill Creek (South-

pebbles may have been so used as "anvils," and thus have formed part of one of the many arrowhead-making processes.

That they involved some more elaborate operation than that denoted by mere pebbles with bruised edges is manifest. At all events it is high time, in view of the number of stone hammers, whose use has been explained at quarries in the last two years, that battered pebbles which are pitted, and those which are not pitted, should be kept distinct and their difference marked as of important archaeological bearing in future discoveries.

If Mr. McGuire is right, they must be regarded, wherever found, as proofs of Neolithic culture. As he says, Dr. Schliemann found these so-called "corn bruisers" fifty-two feet down in the lower layers at Troy. They are found often in Ireland. They have been dredged out of the mud at the Swiss Lake Dwellings, and exhumed from English Barrows. Messrs. Lartet and Christy found them in the French Paleolithic caves (covering, by De Mortillets' classification, at least two epochs) of Les Eyzies, La Madeleine, Gorge d'Enfer, and

ampton). Fifteen are pitted only on one side, of which four show no signs of use as hammers. Two are little rectangular pieces of soft shale, of which one has two pits on adjoining sides. Five show signs of rubbing on the periphery. One is a flat tablet seven inches long and one inch thick (which might have done as one of the basal stones set in a notched tree for large blade flaking by pressure mentioned by Clement L. Webster (Smithson Rep., 1887, Part I.). Six are elongated about three times their diameter. If an arrowhead maker wanting fresh flakes had set one of his hammers on his knee and splintered a lump of jasper set upon it with another hammer, experience showed me that he would have produced the erratic dents and scorings rather than distinct pits, that characterize most of the specimens. Yet several so pecked seemed on trial too light to use as anvils. On the other hand, the scorings, however irregular, were in all cases of decided assistance in holding the stones by Mr. McGuire's method with thumb in one pit, second finger in or against the other, and index finger lightly resting on the periphery. In this way I made an axe groove around a hard sandstone pebble in about an hour, striking about ninety blows to the minute. Grasping the hammer with the whole hand, or holding the index finger in a pit, strained certain muscles below the elbow, and took the very effective rebound out of the blows.

Laugerie Basse, so that the tool has seemed to range back through the European subdivisions of Neolithic into Paleolithic time, and to stand for many grades of culture rather than one.

But if, following European classification, we go a step in evolution below the Cave man to the man of the River Drift, it must be remembered that no pitted hammerstone is yet known to have been discovered among his remains. No mention is made of any *percuteur* pitted or unpitted from the French gravels at Abbeville or Chelles by M. Gabriel de Mortillet (Le Prehistorique, Paris, 1885), M. A. Bertrand (La Gaule avant les Gaulois, Paris, 1891), or M. Salomon Reinach (Antiquités Nationales, Firmin Didot, Paris). I could see or hear of no pitted hammerstones from the English Drift at the British Museum[1]; and at Abbeville I heard that little attention had been paid in France to their discovery in the gravels. There, though M. du Mesnil described finding several, which I did not see, in the middle and upper beds, they were not pitted. Whatever the full meaning of the pitted tool, the Quarternary hunter of the Somme and Ouse has not yet, I believe, been proved to have known its use.

Here, then, is evidence which would disincline us to suppose the quarries at Gaddis' Run the work of possibly Glacial men from the Trenton beaches. For here we find in the quarryman's workshop tools which neither the alleged Trenton man, nor his European prototype, have thus far been suspected of making, and which, old as they may be in type, are known to have been included in the outfit of the modern North American Indian.

[1] Since this was written I have seen hammerstones (*i.e.*, bruised flint nodules) found at the Drift blade workshops of Stoke Newington and Caddington by Mr. W. G. Smith. But none were pitted.

"TURTLEBACKS."

Three hundred and twelve leaf-shaped chipped forms of argillite, for which the indefinite "turtleback" seems a good name (see Figs. 21 and 22), present us in the main with the same problem offered by the similar objects at the jasper

FIG. 21 (× 1/7). — Average "turtlebacks" and hammerstones from the refuse. Found underground in shafts A and G.

quarries above mentioned. About a hundred more ends and points of broken specimens form our complete stock of blade evidence. The material, though softer than jasper, is far more regular and easily worked. Had it been jasper, its connection with the modern Indian might have been inferred from the work done at other jasper quarries; but being the same stone used by the alleged Paleolithic man of Trenton, it is necessary to again make sure of our ground, so that we are excusable

for restating some of the well-known points of quarry evidence in general, noting —

a) That the "turtlebacks," none of which show signs of use on their edges, cannot have been wanted by their makers, or they would not have been left to the extent of one to about

FIG. 22 (× ⅛). — "Turtlebacks" of unusually large size with large chip showing bulb of percussion and two large hammerstones.

every bushel of chips. Some may have been unintentionally lost (like two finished blades at the camp workshop to be described), but the great majority must have been "wasters" or "rejects" cast aside in the process of the work.

b) In their present state they are as much "finished" as the Trenton specimens. Therefore, if the latter are tools, the quarrymen were not making *such tools* at the quarry; for if they

had been, they would have wanted them, and if they had wanted them, they would not have left them.

c) Not a single one of the thinned-down blades, broken or whole, so sparsely found at Piney Branch, not a trace of one of the broad argillite cache blades, so common at the Delaware Indian sites, were met with in all the tons of refuse overturned. (See Fig. 22.)

d) Two of the "turtlebacks" were very much larger than alleged implements from the European Drift or from Trenton.

Considering these facts, while it was evident that the quarries could not be connected with a Paleolithic race living seven, ten, or thirty thousand years ago at Trenton, it remained a question whether they could, after all, be fairly referred to the geologically modern Indian, whose village site lay but half a mile away.

It was plain that the chipped forms represented an effort, which effort was first the production of something good enough to take away, while the secret of what that something was was in our hands, in the chips, in the points, in the "turtlebacks" themselves, for there was nothing else to tell the tale.

Carefully reëxamining these latter we noticed, first, that after all they were not made like the average Trenton specimens, though they resembled a small group of the latter (see Fig. 13); second, that strange as it might seem, they did not fairly resemble the numerous others found by me in neighboring Indian village sites, with which I at once compared them. Considered altogether, they were certainly a class by themselves. Thinner, as a rule, than all other argillite specimens that I had seen, and made with far fewer blows, the chippings had a broad, regular look, and ran nearly across the full surfaces. Generally they formed but four facets on a side (to the average six or seven of the village site specimens); often they showed but three, and sometimes only two.

Evidently they had been made with great skill; and, while I had no trouble in reproducing the village site specimens, these defied my efforts. In trying to copy them, however, I considered my labor rewarded in finding to my satisfaction that much of their "knack" was in a knowledge of the grain of the stone. The neighboring curbstone cutters knew and showed me that the cleavage plane of the rock was straight and at right angles to the seam breaks; that along this plane it splits, breaks, or flakes easiest; and that while good flaking may be done at angles ranging away from this plane to nearly forty-five degrees, but no farther, the nearer the direction of the blows approaches it the better.

To illustrate this, imagine a mass of argillite shaped like a thin brick. Place it broadside down on a table, and let the grain run parallel with the table top. Lifting off the block, strike the right-hand lower edges inward blows below the upper corner, and you can knock off flakes that run diagonally half across the under side. Then turn the block upside down and repeat the operation on the other side. The result is an elongated mass, lozenge-shaped in section, with two sides showing the conchoids of your chipping, and two sides showing the level planes of the natural cleavage. But it is the position of these two latter planes, from which the longest possible flakes can be obtained, that makes your "turtleback" (if you have rounded the corners without breaking it or spoiling them) the thing best fitted, it would seem, to work down into a broad, thin blade. That end, we believe, was best attainable by chipping on the planes referred to till the desired thickness was reached.

By a little thought it will be seen that any other direction of the grain in your block prevents the possibility of these opposing planes and decreases the chances of further flaking. So would a false blow in forming the side facets, or rounding the ends; and when we find that nearly all our "turtlebacks" have

failed in these conditions of supposed desirability, we have a plausible hypothesis to explain why they were cast aside.

It is, therefore, the very rare specimens which may be supposed to fulfill these conditions, and which we believe were not rejected, but rather lost unintentionally, that particularly interest us. They, if we can find them, will represent the full extent of the quarry work.

Let us look for them, then, among the fractured ends and points, hoping there to get a blade broken by its maker after it had to some extent passed the "reject" stage.[1]

It is well for our hypothesis that in eighteen of the points the broadest and flattest planes, sometimes running the whole length of the specimen, as if struck at a single blow, and so inferably the cleavage planes (or a near approach to them), lie diagonally opposite each other; and when we examine the outer edges we notice, first, that all are slightly nipped at certain places as if struck very light blows with a small pebble; and second, that these nippings regularly occur at the outer edge of the broadest, flattest planes, but *always on the side opposite to them.*

Here, then, besides their shape, is a clue to the specimens themselves, indicating that further work was to be done on them; for, had the nippings been made simply to symmetrically outline the "turtlebacks," they would sometimes have been struck on the side of the planes. But being, wherever obviously intentional, always opposite to them, I regarded the nippings as adapted to subsequent flaking; for, granted that the planes were the main surfaces for flaking, had the nippings been on their side, they must needs have hindered the flakers' operation, whether the method used was pressure, or percussion by bone

[1] It has been objected that it is not fair to regard broken ends as types of finished work, since, if finished, the blades would not have needed the extra blow which broke them. But at the Indian flaking site afterward examined, we gathered eight fragments of thin blades which, though larger than the two perfect ones found, were equally finished.

or stone. Now they would enable the antler punch or the hammer to "bite," as the flint knappers of Brandon say. In other words, to take deep hold of the edge and send off long flakes.

Three of the unbroken "turtlebacks" (see Fig. 23) seemed to fulfill the conditions of the good points, and may therefore have

FIG. 23 (× about ⅓). — "Turtlebacks" which were probably not "rejects." They seem to show the highest degree of finish attained at the quarries. When the blade-making work had reached this stage the blades were probably carried away to be thinned down elsewhere. Compare with Fig. 13.

been lost rather than cast aside. Some showed rottenness on their corners; some ragged flaking; some were disproportionately thin in some places; some had the clumsy intractable "hump" more common among the jasper specimens. But admitting the possibility of the above observations on the method probably employed, it was not hard to see why most of them had been cast aside.

At all events the quarryman's object was to block out a blade and produce a "turtleback" more symmetrical than the Trenton average forms, and superior to anything of that well-known category afterwards found at the neighboring camp site. When, with the fewest possible skilled blows he had done so, and had fashioned an inchoate leaf-shaped form, well adapted for the flaking that was to reduce it to its final character, his work at the quarry ended.

Where the chosen "blanks" were to go, what was to become of them elsewhere, we had yet to learn.

Lastly, and not to be overlooked in the study of the quarry "turtlebacks," was a consideration best appreciated by the investigator who had seen and handled the specimens. He realized that while as a class by themselves the quarry blades, characteristic and eye-catching as they were, could be easily set apart from the *average* Trenton specimens, *a certain limited number of the latter* (see Fig. 13), labelled as found in place in the Glacial gravels, bore the sort of family resemblance to the quarry products that various specimens of the same hand-writing present to the expert eye. So strong in my opinion was the resemblance that it reasonably challenged the Glacial record of that part of the Trenton list referred to. They, at least, had a peculiar stamp of modernity upon them, whatever might be thought of their fellows in the Peabody Museum.

Having gathered these results, the quarries had nothing further to tell us. Our work, persistently continued in the hope of some sensational or clinching discovery, simply repeated old evidence and added nothing new. Yet by it we had come to realize what may be summed up as follows:

a) That the presence of three pitted hammers associated the work with a Neolithic people rather than the alleged Drift men of Trenton.

b) That the mere presence of the "turtlebacks" again disconnected it with any people like the alleged Drift men,

who, if they had made the blades, as finished implements would have wanted to use them, and so would not have left them.

c) That, though seeming to belong to a special class, the shape, position, and general appearance of the "turtlebacks" allied them with work known to have been done by modern Indians.

d) That the position of the quarries seemed again to closely connect them with the Indian, rather than any other possible race, lying as they do, as remarked before, on what might be called a pathway littered with Indian blade material, leading directly from the ancient mines to an Indian village only half a mile away.

e) That, granting their connection with Indians, the absence of a growth of forest mould over the workings argues against their great age.

f) Lastly, that the resemblance in make of a certain number of Trenton specimens to the quarry series suggests that the former had been made by modern Indians and intruded by them into the gravels.

Taking a last look at the bare chip heaps and pits unfilled with detritus on the steep hillside, and reasonably doubting whether years numbered by the thousand could have rolled over them, I turned away to the suggestive topography of the spot, and the interesting features of the point next to be studied.

The Bed of Gaddis' Run.

I have called the bed of Gaddis' Run a pathway because, though drier now than in the days of the Great Forest, any ancient people ascending the bottom of the narrow ravine must have walked by preference on or close to it to avoid unnecessary clambering along the steep slopes.

As far as appearances went it was a quarry in itself, and the wonder was that the ancient stone chipper should have mounted the slope to dig argillite blocks buried seven feet deep out of the ground, when he here had, to all appearances, equally good ones in inexhaustible supply, lying on the surface. That at the time of the quarries the stream's bed was probably far less widened by freshets and often brimful of water may have accounted for the absence of worked stone along the margin in part; but I looked for the reason in the fact explained to me by the curbstone cutters, and afterwards proved by my own experience in chipping freshly unearthed masses, that argillite flakes best when newly quarried and wet. This was a feature of the stone in distinction to the quality of the flint of eastern England, which has to be dried by stoves or in the sun (as the "knappers" of Brandon told me) before working, and to that of the blocks of hornstone which Mr. S. P. Leland (Smiths. Rep., 1881, Part 1) saw Indians flaking by pressure with hot stones.

In a careful study of the ravine from the quarries to the river, the following facts were noted.

a) A broken yellow jasper pebble, about 1½ inches in diameter, lay in the stream's bed opposite the lowest quarry pit. Nearly a square inch of water-worn surface showed, but there was no sign of chipping. The bruised, irregular fractures and the red tints at places indicated that it had been subjected to fire. It inferably came from the Delaware River and was dropped by Indians somewhere along the stream.[1]

b) Four pebble hammerstones, three of quartzite, and one of hard sandstone, or trap, 5 inches, 3, and 1½ inches in

[1] A few days afterwards I found a large pebble five inches in diameter on the right river beach, one mile above the Point Pleasant Bridge. Two years before, I had found another, on the right bank, at the mouth of Pidcock's Creek, below New Hope. The specimen in Gaddis' Run was probably handled by Indians; and as it could not reasonably have been water-worn in the manner evidenced since it was dropped, they must have found it on the river in the first place, and not at any of the jasper quarries.

largest diameter, respectively, four argillite "turtlebacks" of quarry pattern, and four large chips were found in the bed of the stream at distances of from 20 paces to 600 feet below the quarries. Two of the "turtlebacks" were lying near the chips. They may have been washed down from the quarry refuse, and were probably not made on the spot.

c) About 870 feet below the quarry the ravine widened a little and a small cornfield opened on the left bank. There I picked up several fire-fractured pebbles, the well-trimmed point of an argillite blade of cache form, 1⅞ inches broad and ½ an inch thick. Near it lay two long, thin, knife-like flakes, triangular in section, two heavy chips, one imperfectly chipped blade 3½ inches long, 1⅛ wide, and ½ an inch thick, besides two "turtlebacks," apparently ruder than the average quarry type. Without attempting to draw any inference from the "turtlebacks," the features of the spot were significant. Besides the suggestion of habitation furnished by the fire site, we had a worked stone point and flakes evidencing the existence of a kind of blade-making that has long been familiar to us as the work of the Indian.

d) The ravine opened into the river valley when we had followed the stream down to its mouth in the Tohickon, and 833 yards farther along the now free shores brought us to the mouth of the latter in the Delaware, near which, on the right Tohickon bank, about 200 feet from the stream, the unmistakable refuse of an Indian blade-trimming workshop lay scattered among the weeds and boulders.

So much for the bed of Gaddis' Run. It was the means of ingress into the interior which the river tribes must continually have followed. That it had been an Indian pathway the cornfield site, and now the workshop, proved beyond a reasonable doubt.

By this way the littered trail of blade material had led man, while yet a blade chipper in the Age of Stone, to the purest

source of the rock, and the evidence had thus far indicated that the man so led was the modern Indian.

An Indian Blade Factory.

There was no doubt as to the Indian parentage of the objects found among the chips at the workshop: the two broad,

Fig. 24 (× 1/7).—The "turtleback" explained. Fragments of thinned blades, chips, and "turtlebacks" from the Indian blade factory at the mouth of Gaddis' Run. One of the "turtlebacks" and two ends marked "TS" seem to have been brought from the quarry.

thinned-down blades of argillite, 3⅞ and 4¼ inches long, respectively; the eight ends and twenty points of similar broken blades, the broadest 3 inches wide by 1/2 an inch thick, the narrowest 1⅛ inches broad by ¼ an inch thick; the sharp end of a polished sandstone celt; the two or three pebble hammerstones, one of which was pitted on one side; the two yellow jasper chips and three small black jasper or chert fragments,

one showing a water-worn surface, and the one unsymmetrical argillite blade, chipped thin and evidently unfinished (see Fig. 24). Nor were we surprised to discover among them eighteen "turtlebacks."

With the celt, the thin blades and flakes positively connecting the site with the Indian, we here looked for evidence of the very kind of work we wished to see. Granted that loads of the successful quarry "turtlebacks" had been carried away to Indian workshops like this for thinning down into the sort of blades we were now finding, here at this first riverside halting place below the quarry we might hope to discover the "missing link," the "turtleback," which, having been a success at the quarry, was carried hither and broken, lost or cast aside in the new process.

But the specimens found were confusing. True, *one "turtleback,"* one end, and a point seemed fully up to the desired standard of the quarry. The former, with its flat opposing planes, fulfilled my notion of what constituted the object of the quarry workman, — a successful inchoate blade which was not a "reject," and which would have been carried away from the diggings as fit for future thinning. The trouble was that it, and the two other specimens exactly resembling the broken ends and points at the quarry, had not been modified by any new flaking. Whatever the handicraft involved in the making of the surrounding thin blades, there was no sign of it on these three specimens. If any of the thin flakes had been worked from them, they, the latter, would have shown conchoidal grooves on their surfaces to prove it; but they did not. The inference, therefore, was that this particular "turtleback," after having been brought to the workshop, had been lost, and that if, as appeared, the two broken specimens had been made at the quarry, they had been carried down to the workshop after they were broken.

On the other hand, the seventeen other "turtlebacks" found

at the workshop were more worthless "failures," judged by our standard, than the worst at the quarry. Six of them were only about two inches long, two were very large and circular in form. Irregular and thick, they showed no trace of systematized plan. Had such specimens been desired at the quarry, then no "turtleback" would have been left there. This obvious inferiority in form, and their position among heavy chips, chipped blocks, and argillite boulders, proved, therefore, to my satisfaction, that these latter "turtlebacks" had been made not at the quarry, but on the spot. Here, then, at the source of the material, we had come upon two sorts of the much discussed "turtlebacks" — "turtlebacks" of the quarry and "turtlebacks" of the riverside. "Turtlebacks" made according to a system, with special knowledge of the grain of the stone, and *from material dug out of the earth*, and "turtlebacks" made as if carelessly, without system and at haphazard, from material lying on the surface about the beaches. But why (with the one exception noted) were the preferred "turtlebacks" of the quarry not brought down to the workshop?

The unexpected absence of quarry-made blades puzzled us completely until the following consideration seemed to explain it. It was that if the work of quarrying, blocking out, and thinning down were properly done, there ought to be no quarry "turtlebacks" found at the workshop at all. The reason was plain. Any "turtleback" carried from the quarry to the workshop had, *ipso facto*, passed the failure point. Too good to be cast aside as a reject or waster, it was now ready for another process, — that of thinning down. If the thinning work went wrong, or it broke during thinning, it would be cast aside as a failure of another kind, which let us call a workshop failure. But the more thinning work done upon it up to the point of this latter failure, the less would it look like the thing it was when it left the quarry and first arrived at the workshop,

namely, a "turtleback." In a word, no quarry "turtlebacks" would have been brought to the workshop except those that would thin down; and those that would thin down did, as a rule, thin down, soon losing their "turtleback" character, unless lost, broken, or crossed-grained. So then, though many quarry "turtlebacks" may have been brought to the workshop, very few might reasonably have been expected to be found there.

Granted, on the other hand, that "turtlebacks" had been made at the workshop, it was as easy to see why those of them that were failures had been left there, as to see why those of the quarry "turtlebacks" that were failures had been left at the quarry.

In fact, the workshop repeated the story of the quarry and something more. There, as at the quarry, "turtlebacks" were made from material at hand; but at the workshop the successful "turtlebacks," instead of being carried away, were then and there thinned down into blades. So much, then, for the eighteen "turtlebacks" found at the workshop. Seventeen were "rejects," made on the spot and cast aside; one was probably a successful blank brought from the quarry and lost. As for the broken end and point of quarry pattern, their presence remains a mystery, unless we suppose such pieces to have been occasionally brought away from the mines to be worked up into small objects.

One more question remained to delay us at the workshop. A glance had shown us that the flakes, some of them three inches long and scarcely one-eighth of an inch thick, were utterly unlike the thick heavy chips of the diggings; and as we examined the broken thin blades, themselves unmistakable evidences of a stone-chipping procedure, distinct from that of the quarries, we might well ask the question, what was the flaking process practised at the workshop? How were the "turtlebacks" that would thin, thinned down into blades?

Mr. William A. Adams, a miner of Denver, Colorado, told me in September, 1893, at New Galena, Bucks County, Pennsylvania, that he had seen in about 1864, Pendoreilles in Crow Creek Valley, Montana, Crows in Yellowstone Valley, and Flatheads in Montana chipping arrowheads by blows with porphyry and quartz pebbles, and *iron hatchets* upon splinters shivered with pebbles or iron hatchets, from masses of obsidian about six inches in diameter.

Lieutenant E. J. Beckwith (Pacific R.R. Survey, Vol. II., p. 43), in June, 1854, saw Indians on the Sacramento River, in California, making arrowheads from quartz fragments by direct pressure with bone punches creased or grooved on their ends.

B. B. Redding (Am. Naturalist, Nov. 1879, p. 667) saw a Cloud River Indian, near Mt. Shasta, send off an obsidian flake by a blow on a bone chisel, from which he made an arrowhead by direct pressure with an antler punch.

Stephen Powers (Contrib. to N. A. Ethnology, Vol. III., p. 104) saw, in 1875, Wiyot Indians, on Humboldt Bay and Eagle River, northern California, make with bone tweezers arrowheads from flakes of chert split in the fire. Edwin A. Cheever (Am. Naturalist, May, 1870), about 1840–60, saw California Indians nipping arrowheads of obsidian with notched bones. Paul Schumacher (*Archiv für Anthropologie 7, 1874, p. 264*), about 1860–70, saw Klamath Indians, of northern California, by direct pressure with bone-tipped punches, making arrowheads from chips splintered from fire-heated masses of flint obsidian or jasper. Caleb Lyon (Bulletin Am. Ethnolog. Soc., Vol. I., p. 39), about 1860, saw a Shasta Indian, in California, chipping an obsidian flake into an arrowhead about one inch long, by direct percussion with an "agate chisel."

Captain John Smith (6th voyage), about 1606, saw Virginia Indians making heart-shaped arrowheads by direct pressure with "a little bone." Catlin (Last Rambles among the Indians, Chap. V., pp. 187–190), about 1860–68, saw Apaches

making arrowheads by blows with wooden mallets upon bone punches set against chips of flint. Admiral Sir E. Belcher (Trans. Ethnolog. Soc. of London, 1861, p. 138), about 1858–60, saw Eskimos, at Cape Lisburne, making blades by direct pressure with antler punches on obsidian flakes laid over spoon-shaped cavities in logs; and, as noted before, S. P. Leland (Smiths. Rep., 1887, Part 1), about 1850, saw Indians (unnamed) flaking hornstone by pressing down on it with pebbles about five inches broad and six long, heated in the fire.

Discussion of the above interesting accounts seems out of place until we have more satisfactorily verified them by experiment. Suffice it here to note that all, with two exceptions, refer to flaking with a bone punch, either by directly pressing on it or by hammering it while held against the stone.

As all seem to refer to the making of comparatively small arrowheads and hence to the producing of flakes, none of which probably needed to be over half an inch long, we must turn to the following for suggestions as to the broad blades and formidable flakes found at the workshop.

Torquenada (*Monarquia Indiana Seville, 1615*), in the beginning of the seventeenth century, saw ancient Mexicans sending off obsidian flakes six and seven inches long, with wooden mounted bone punches set against their breasts, from cores held between their feet.

But I know that flakes nearly as long and thin can be sent off English flint by direct percussion, for I saw the "knappers" at Brandon knocking them from similar cores with steel hammers.[1]

Catlin (Smiths. Rep., 1885, p. 870) told George Ercol Sellers that he had seen Indians flaking jasper and agate with long wooden punches set with bone points, weighted with hanging stones, and held against their breast. When the pres-

[1] Three of these sets of flint flakes with their cores I have placed in the archaeological museum of the University of Pennsylvania.

sure was applied, a coöperator struck a fork in the punch a blow with a club.

Dr. Knapp (Smiths. Rep., 1887, Part 1) saw Indians on Twelve Mile Island, in the Mississippi River, near Guttenberg, Iowa, making arrowheads by pressing down on the stone with the side of the leg bone of a deer used as a lever, and set in a notched tree. The notch was large enough to hold the blade worked upon and a basal stone on which it rested.

George Ercol Sellers (Smiths. Rep., 1885, p. 870) heard from a trapper who had seen Indians sending off large flakes by leverage of the same sort. A long wooden lever was set in the notched tree; a bone point fixed in its side pressed down upon the blade, which rested on a flat root. When the pressure was applied, the lever was struck above the bone with a mallet.[1]

So much for the accounts which I believe comprise all of importance thus far published in America by eye-witnesses. We learn from them of flaking (*a*) by direct percussion; (*b*) by indirect percussion, or hammering on punches; (*c*) by direct pressure; (*d*) by impulsive pressure, or pressure aided by a blow; and (*e*) by pressure aided by heat.

Moreover, we have hints in the descriptions as to digging some stones out of the ground and gathering others on the surface, wetting some and drying or baking others, and we fully realize that we are grappling with a very intricate question.

Almost dismayed at this greatest craft of the Stone Age, and dissatisfied with our own inadequate attempts to master it, we can well appreciate the remark of Catlin, that "great skill was required and a thorough knowledge of the nature of each stone, a slight difference in quality necessitating a totally different manner of treatment."

[1] In collecting certain of these interesting narratives I have been indebted to the kind assistance of Messrs. W. H. Holmes, of Washington, and A. F. Berlin, of Allentown.

Until observation or experiment shall have enlightened us further, we must remain in the dark as to whether the blades at the workshop in question were made by any of the kinds of percussion or any of the kinds of pressure described, realizing only that whatever the process employed, it was widely different from that kind of percussion used in fashioning the "turtlebacks" at the quarries.

But the main point of our investigation of the refuse had been reasonably established. The blade factory was the work of modern Indians, and was an adjunct of the quarry.

The Indian Village Site at Lower Black's Eddy.

Our investigation thus far had traced the "turtleback" of the quarry to the riverside workshop, and had connected both quarry and workshop with the modern Indian, — the Indian whom De Vries encountered on the Delaware in 1631, and Campanius in 1643; the Lenni Lenape, who, with his Shawnee wards, may have been living at the spot as late as 1737, when Richard and Thomas Penn bought the right river bank by the deed known as the "Walking Purchase."

Between the date 1737 and that other vague time in the valley's history towards which investigation has essayed to reach, the period of the melting of the great glacier, geologists say that an epoch of seven to ten to thirty thousand years has elapsed.

Yet this is the gap of time which archaeology alone may hope to fill up with the lost story of humanity; and it is because of the human landmark seen, or supposed to be seen, at the other end of this vista of millenniums that we reach into the darkness for traces of man in the intervening time.

If man was in the valley when the glacier melted, what had happened to him in these thousands of years? Had he remained to slowly evolve into the Indian, or had he perished or gone to

come again, having worked out his development, such as it was, elsewhere?

These are the questions which confront the investigator as he looks backward over time-recording strata to the Glacial landmark. They have lost the garb of merely local interest and concern the study of mankind throughout the world.

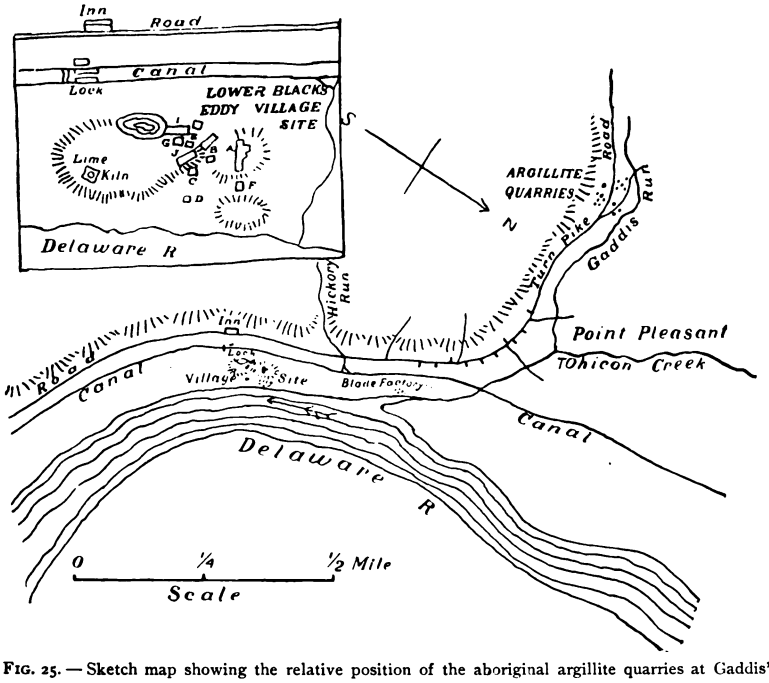


FIG. 25. — Sketch map showing the relative position of the aboriginal argillite quarries at Gaddis' Run and the Indian village site at Lower Black's Eddy.

Descending the river bank for 140 yards, and crossing the mouth of Hickory Run, we reached the Indian village site of Lower Black's Eddy, where the stone implements, falling from the freshet-torn banks, had for years furnished local collectors with their "relics."

This village site (see Fig. 25) was a definite starting point at the modern end of the problem of the valley, and the evi-

dence as to our quarry and its workshop would not be all in till we had examined it.

Having learned from Mr. Andrew Schwartz, of Point Pleasant, that the long bank of alluvium which, in his boyhood, had edged the river at the spot, had been cut in two by the freshet of 1841, leaving the present appearance of two mounds,[1] and having proved by several experimental shafts that the village refuse that had once evenly capped the whole bank, had been displaced and disturbed by freshet washings below and between these hillocks, we determined that the hillocks alone, if shafted, would reveal the true and original position of the refuse, and so, accordingly, cut a deep trench through each of them.[2]

Both hillocks, when thus exposed in clean section (see Fig. 26), showed (*a*) a surface layer from 2½ to 3½ feet thick, containing abundant traces of Indian village occupancy; (*b*) below it a middle band of undisturbed sand plainly scored with lines of stratification 1½ to 3 feet thick; and (*c*) still below the stratified sand another blackened relic bearing stratum 1 foot to 1 foot 10 inches thick, proving an earlier occupancy.

Man had, therefore, lived once upon a lower bank. His habitation had been overwhelmed by water or overlaid with sand, and he had again occupied the surface. There were two village sites, set one upon the other, — an upper and a lower. But as the lower might have been overwashed with sand in recent times, since the top of the whole bank was only 14 feet 6 inches above average water level, and as the 1841 freshet had risen quite high enough above that to do the work, geology could assert no great antiquity for either site.

[1] On the lower of these stands a ruined lime-kiln, built about 1810.

[2] Trench A, in the upper mound, 56 feet long, 4 wide, and 8 to 11 feet deep. Trench J, in the lower, 40 feet long, 4 wide, and 8 to 12 feet deep.

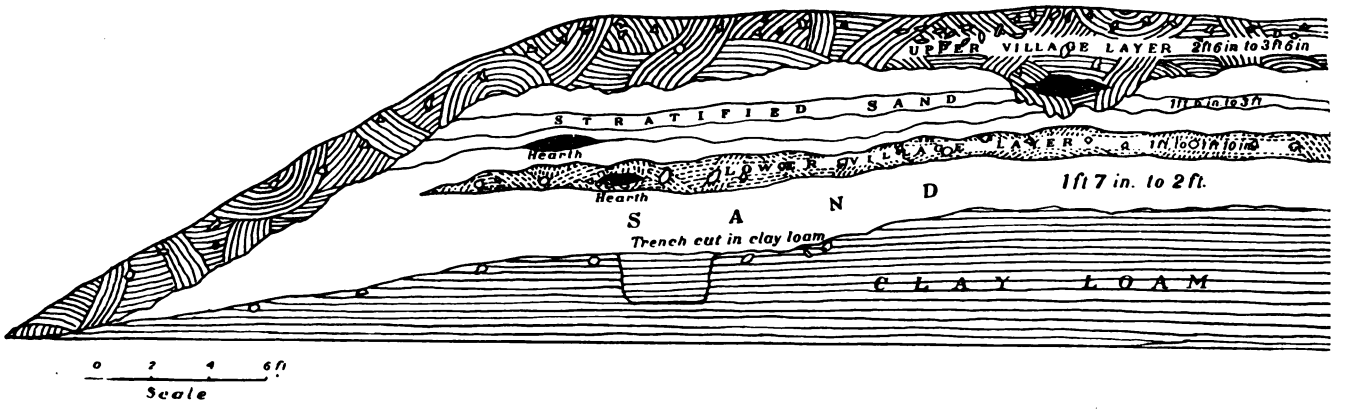


FIG. 26. — Section of trench A at Lower Black's Eddy showing the position of discolored layers marking an upper and a lower village site.

Neither could the study of the layers, thus situated at the mercy of present freshets, prove any great lapse of time between the lower and upper times of habitation.

As far as their testimony was concerned, the upper site might have been inhabited one or five hundred years after the lower was overwhelmed. If, therefore, we sought for inference as to the relative age of the two sites, we could only hope to find it in a comparison of the relics discovered.

Realizing this, the depth, position, and association of all the specimens found, and particularly their occurrence above or below the lines of stratification, was carefully noted. Their study gave the following results.

The Upper Village Layer.

In the upper layer *glazed potsherds*, that might first have been bought by the Lenape from Dutch and Swedish traders, about the middle of the seventeenth century, lay everywhere scattered with fragments of the native ware, and in two instances associated with bones (not identified).

No whole aboriginal pot was found; but the curve of the *native potsherds* sometimes indicated vessels that must have been 1¼ feet in diameter if round. The fragments seemed divisible into three classes:

(1) Coarse and heavy, full of pounded quartz, scratched or fabric marked (sometimes on the outside, sometimes on the inside, and sometimes on both sides), reddened on out and inside, and tending to black in the middle, as if burnt without and within.

(2) Like (1) but finer in form and gracefully ornamented with dotted or incised lines on the outside.

(3) Thin, hard, and light, sometimes dark inside and containing no quartzite, but instead bits of pounded argillite, marked

with incised or stamped border lines, dots, and circles and stamped rows of parallel lines often meeting at right angles.[1]

Besides these abundant remains of pottery, the upper layer contained a small decorated metal plate with rivet holes that

FIG. 27 (× about 1/7). — Representative series from the upper village layer. Pottery, "turtle-backs," chips, broad blades, and arrowheads of jasper and argillite.

[1] The finest specimens of it were found years before in digging at the bottom of the water cut between the mounds (above mentioned). Several pieces, stamped with lines in relief at right angles, I find on recent comparison to be generally identical in appearance with specimens excavated from St. John's River (Florida) mounds by Mr. Clarence B. Moore. If further study endorses the view that any of the ware is here out of place, it may, it seems to me, be fairly ascribed to the Shawnese, whose known wanderings from south to north in historic times would have supplied them with superior knowledge of the fictile art. They are known to have lived with the Lenape on the middle Delaware at the beginning of the last century. A band of them left Durham (or Pechequeolin) in 1728.

may have belonged to the mountings of a gun, one end of a *polished celt*, three quartzite unpitted *hammerstones*, two flat, oblong, sandstone pebbles nicked on opposite sides and used as *net sinkers*, six small fragments of *animal bones* (not yet identified), one of them split and associated with glazed and Indian potsherds, jasper and argillite chips and charcoal, and abundant *fire-fractured pebbles*. These often lay in undisturbed beds under masses of blackened sand, charcoal, and ashes.[1]

Besides a partly worked *quartzite* blade, many chips of *white quartz*, and one piece of worked *transparent quartz*, we found three worked blades, several chips and partly chipped pebbles of *black chert*,[2] together with a "turtleback," a thin broken blade, a large worked fragment, and several chips of *a fine-grained red stone* (not determined).

We noticed as a striking fact that the five arrowheads and small blades, whether of chert or jasper, were all of the tri-

[1] Fire fractures, quartzite, and other water-worn pebbles in a very peculiar and unmistakable way in the Delaware Valley. The sandstones sometimes redden. The stubborn quartzites tear into the most irregular shapes. Whoever has seen the pebble-bedded fire of a New England clam-bake has seen the kind of fireplace that the Indians continually made at their village sites on the Delaware. When we find the black mass of charcoal and ashes undisturbed, these stones often lie below them. So I here exhumed them by the bushel from fire sites from 3 to 5½ feet below the surface at Lower Black's Eddy. Similar pockets of burnt stone and charcoal are exposed by the water-wearing of banks at Ridge's Island. The best places to see them in the Susquehanna Valley are, perhaps, Hall's Island (Snyder County) and the bank below Pulaski (Luzerne County), where they are falling from the alluvial walls by the ton.

[2] Seven-eighths of the blade material found on the Lehigh, above the "gap," and on the Susquehanna, between Scranton and Harrisburg, is of this black stone. There is a natural outcrop of it about two miles east of Kutztown (Berks County, Pennsylvania), where I found very slight surface traces of blade chipping, and I discovered an ancient quarry of it last summer, near Selinsgrove (Snyder County, Pennsylvania). Beds of it occur at most of the jasper outcrops in the Lehigh Hills, and a vein must be somewhere exposed by the Delaware or its main tributaries, to account for the pebbles everywhere common on the Point Pleasant beaches. There was no question as to where the specimens here found had come from. Thousands of pebbles of the material lay scattered in the river bed just above the Tohickon's mouth.

angular pattern common at surface sites in the Delaware Valley. One was of argillite and sharply barbed.

In all we gathered fifty-eight *red and yellow jasper* blades and chips[1] from the upper layer, and while digging in the middle of the hillock unearthed a small argillite blade-trimming workshop like the one previously examined, containing over one thousand thin flakes, thirteen thinned blades and broken ends, two of them 2¼ inches broad and about ¼ inch thick; six large masses of worked argillite; four rough (riverside) "turtlebacks," inferably, for reasons above given, made upon the spot, and one of a red stone (not identified).

Disconnected with this workshop refuse, seven other argillite "turtlebacks," several worked masses, and numerous heavy chips, like the quarry chips, were found at various points. In all there were 1210 artificial objects of argillite (including chips) found in the upper layer, 58 of jasper, and 258 of other materials. Argillite, therefore, greatly exceeded all other remaining village site material in the proportion of 6 to 1. To jasper it stood in the proportion of about 20 to 1.

So much for the upper layer. The lower village layer presented us with different evidence.

[1] I do not believe that jasper pebbles are very uncommon in the Delaware bed. As I stated before, I found one in the gravels at the mouth of Pidcock's Creek, and another on the beach, a mile above the Tohickon's mouth. No doubt some working was done from these pebbles so found by the river peoples. With our positive evidence as to their use of similar specimens of black chert, there is other ground for the inference that man, at his first coming in the Delaware Valley, obtained all his blade material from the river bed, and continued to do so till the quarries were discovered. Some of the coast Indians of southern New Jersey did not need to resort to the hill quarries for jasper, for at the village site on the Great Egg Harbor River, below May's Landing, I found jasper pebbles common on the beach. One was partly chipped, and there was no trouble in matching all the surrounding flakes among its fellows. The same thing proved the case on the lower Chesapeake, where I found the Sand Hill Dunes on the Choptank (Dorchester County, Maryland) scattered with chips and partly worked jasper pebbles matching those on the bay shore below. The source of jasper, therefore, east of the Pennsylvanian Alleghanies, was by no means always the quarries above noted in the Lehigh Hills.

The Lower Village Layer.

Here we found two net sinkers, two coarse potsherds of the kind specified above as class 1, nine pebble hammerstones, several black chert chips (some showing a pebble surface), and at a depth of 5½ feet two small fragments of anthracite coal about the size of a pea, which, like two larger coal pebbles found afterwards on the neighboring beaches, may have been washed from anciently exposed coal layers in the Lehigh region, and so have formed a component part of the original alluvium.[1]

We discovered, besides, one small quartzite blade and one worked quartzite pebble; one "teshoa" (circular flake, chipped from the side of a pebble and used as a knife); several chips of unidentified stone; thirteen argillite arrow or spearheads of the long, narrow, "fish spear" type, whose length averaged from 3½ to 5 times their breadth; one similar type of black chert; one long narrow knife of the same proportion, of argillite; one broad broken blade and one point of argillite resembling the coarser types found at the workshop in the upper layer; one partly worked oblong piece, five yellow chips, and one fragment of yellow jasper.

Besides this we found fifteen rude argillite "turtlebacks," together with heavy chips and several large worked masses. Most interesting of all, perhaps, was a group of thirteen coarse chips, two "turtlebacks," 5½ and 3⅜ inches long, respec-

[1] Coal veins outcrop on the riverside mountain tops at Mauch Chunk where the "mammoth bed" was first quarried in 1792. Small fragments of anthracite have been reported (Pa. Geol. Rep., Vol. XIII., 1874), in the Trias by the Schuylkill, near Phoenixville. A small vein is now being worked on the headwaters of the Neshaminy, near Chalfont. Mr. S. Edward Paschall says that he has seen particles of coal in place at Bridge Valley and Dark Hollow, on the Neshaminy, and a small coarse deposit is said by Charles Keller, of Point Pleasant, to exist on the right bank of Tohickon Creek, near the Haycock, so that the presence of hard coal particles in the alluvium of the Delaware and its tributaries need not indicate the intervention of white men.

tively; two very clumsily chipped arrowheads, 2 to 3 inches long, and a very coarse broad broken blade, 2⅔ inches long, 1¾ inches wide, and 1/2 an inch thick,—a small workshop, in fact, where some method of blade-making more primitive than any yet studied, and still resulting in "turtleback" failures,

FIG. 28 (× about 1/7). — Representative series from the lower village layer. Pottery, "turtlebacks," and blades, mostly of argillite. Arrowheads of the so-called "fish spear" type.

had been carried on. But the razor-like flakes of the upper workshops were wanting altogether, as they had been wanting everywhere else in the lower layer, and the fact indicated that the process of broad blade manufacture so common above had either been little known or little practiced below.

Again argillite immensely outnumbered all other material. Of the 462 artificial objects found on the lower layer, 427 were of argillite and only 7 were of jasper. Argillite, therefore,

stood to all other relics in the proportion of 12 to 1, and to jasper in the proportion of about 61 to 1.

So much for a comparison of the upper and lower village layers. It brought strongly to our notice the following facts.

That the sure traces of white contact everywhere noticeable

FIG. 29 (× about $^{2}/_{13}$). — "Turtlebacks," blades, and chips of argillite found lying close together in the lower village layer.

above were not found below. That only two rude potsherds were found below, while many of their type and of other types occurred above. That the small triangular arrowheads seen above were not discovered below, while the "fish spear," common below, was, with one possible exception, not found above.

That while jasper was common above, only six chips and one worked blade of it were discovered below.

That neither the fine flakes nor the associated large, thinned blades of cache pattern (with one doubtful exception), marking the trimming workshops above, were found below.

And finally, that argillite, though in excess of all other material in both layers, was three times more abundant in proportion to jasper below than above.

In carefully considering these differences as possibly indicating the existence of an earlier people, or tribe, who had not met white men, who had not developed the potter's art and had not made triangular arrowheads, who had not yet mastered the craft of thinning broad blades, and had scarcely begun the use of jasper, — in asking, in a word, whether these lower people were forerunners possibly of the Lenni Lenape of the surface, we may not afford to overlook the migration legends of that people as preserved by Heckewelder (Indian Nations, p. 51), and the Wallum Olum, or Painted Stick Chronicle (Lenape and Their Legends, Brinton, p. 207).

The latter curious record, whose authenticity is tolerably well established, places eleven chiefs between the arrival of the Lenape at the Delaware Valley and the coming of white men (say Hudson, in 1609); and if we give twenty years to a chief's reign, the date of their first coming would have been about 1387. This agrees with what a Lenape told the Rev. Charles Beatty, in 1767 (Journal of a Two Months' Tour West of the Alleghany Mountains, Charles Beatty, p. 27, London, 1868). When counting beads on a wampum belt as years, according to tribal custom, he said that his people had come to the Delaware 370 years before, or in 1397.

The Heckewelder version of the tradition, however, which gives no means of fixing dates, would infer that the newcomers found the country vacant. The exploring parties of the eastward migrating tribe, it says, arriving at the Susquehanna, followed it down to the Chesapeake Bay, then ascended the bay and outer seacoast and discovered the Delaware River,

New Jersey, and the Hudson River, — a country abounding in game, fruits, and fish, "*and with no enemy to be dreaded.*"

This seeming absence of prior occupants in the new country is again suggested by the Wallum Olum, which refers to the newly discovered land as "a land free from snakes (enemies), a rich land, a pleasant land."

But without attempting to dwell too much on these traditions and their claim that the Lenape only arrived in the Delaware Valley five hundred years ago, and that before that time it had lain uninhabited for an unknown period, suffice it to say that at Lower Black's Eddy we have found two stages of occupancy.

The layers prove a difference in time, short or long. The character of the objects found a difference in handiwork. Future work can alone prove whether this difference denotes a mere accident of varying tribal conditions, or a wide-spreading difference in cultural status. Let us only say now that at this one spot it exists.

As to the quarries, granted that they were connected with the blade-thinning workshops, the presence of these shops on the upper layer and surface, and their absence on the lower layer, would indicate that the quarries, with all of cultural significance that they involved, belonged to the time of the upper layer only, and that the people of the lower site, obtaining their material from the neighboring beaches, had not known or worked them; that, as we suppose in the case of jasper, so, too, with argillite, water-borne masses of the material were followed up by the blade chipper along beach and tributary stream, till the true outcrop of the native rock was discovered, and the quarries at last systematically worked.

The village site, as represented by its upper and lower layer, must be looked upon as a quarry and habitation combined; and while at the less accessible inland workings of Gaddis' Run we looked in vain for a trace of village life, here where the whole beach was a quarry, the riverside "turtleback" maker

had not denied us abundant traces of his true state of culture. It was of the greatest importance to compare this place with the worked refuse on Gaddis' Run, and making use of the opportunity offered by these adjacent sites, to explain the argillite "turtlebacks" of the quarry. In doing so we had come

FIG. 30 (× about 2/13). — Riverside "turtlebacks," arrowhead and thinned blade of Indian make from lower village layer. Compare with the Trenton Specimens, Fig. 2.

upon and clearly distinguished a new class of "turtlebacks,"— the "turtlebacks" of the riverside. And it was not the scientifically made, broadly chipped, and uniform group from the quarry, but these latter coarse, clumsy, irregular specimens (see Fig. 30), averaging seven or eight facets to a side, made with little knowledge of the grain, and from material not dug from the earth but found on the beaches, that (with the striking exceptions noted in Fig. 13, if we judge by form) may be said to resemble the Trenton specimens.

Examining these riverside "turtlebacks," aided by the position of layers at the village site, the evidence seemed to indicate that even they ought to be divided again, that in the lower layer we had reached a series of them that to all appearances had lost their connection with the thinned-down blades of the surface, and were probably fashioned before the quarries were worked. But leaving the question of the particular intent of these latter to be settled elsewhere, we may sum up the whole work done as follows:

We had learned that Lenni Lenape Indians had worked the Gaddis' Run quarry, probably as late as the year 1700, for the purpose of making ovate blanks of argillite desirable "turtlebacks" that would work down into the broad, thin forms called "cache blades," and that in the process many *undesirable* "turtlebacks" or wasters different in type from the characteristic Trenton specimens were produced, which, since they would not thin down into cache blades, were cast into the rubbish heap by the quarrymen.

That the same Indians had worked the riverside trimming-shop, carried thither quarry "turtlebacks" for thinning, and at the same time made riverside "turtlebacks" resembling the average Trenton specimens in form, on the riverside, from surface material, and for the same purpose of thinning down.

That the same Indians had occupied the upper layer of the village site at Lower Black's Eddy, worked its trimming-shop, and again scattered the site with riverside "turtlebacks" made on the spot.

That another tribe of Indians, or band of the same tribe, who had probably not worked the quarry, had at a long or short time previously occupied the *lower layer* of the village site, where they had still strewn the ground with riverside "turtlebacks" resembling the usual Trenton forms.[1]

[1] Professor W. H. Holmes (Are there Traces of Man in the Trenton Gravels? Journal of Geology, Jan., Feb., 1893, p. 33), who had missed the neighboring

Thus to examine the main outcrop of argillite in the Delaware Valley was to concentrate attention upon a spot where successive argillite-using inhabitants of the region, presumably resorting to the neighborhood for blade material, should have left traces of themselves had they existed. But the remains found were, after all, scanty. All referred to the Indian. No token of an antecedent race was discovered, either on the exposed native rock, upon the hills above, or on the beaches below.

Nor has anything yet been found anywhere else in the valley to corroborate the alleged antiquity of the chipped blades from Trenton, while, as remarked before, the Trenton case has been somewhat weakened by the appearance among the exhibited list of Drift specimens in the Peabody Museum of several blades of common Indian pattern (see Fig. 11); and of certain "turtlebacks," (see Fig. 13), which, judged by form, appear to have been made by Indians at the Gaddis' Run quarries. More than ever the question of Glacial man has been narrowed down to evidence produced at one site, and to a question of the correctness of observation of individuals.

quarries when examining the Lower Black's Eddy site, had doubtless noticed the mixture of forms at spots where bank-washing and other causes had disturbed the deposits; but having evidently not dug an adequate trench across the area discussed, he had failed to observe the existence of a distinct lower layer.

EXPLORATION OF AN INDIAN OSSUARY ON THE CHOPTANK RIVER, DORCHESTER COUNTY, MARYLAND,

By HENRY C. MERCER,

WITH

A DESCRIPTION OF THE HUMAN BONES DISCOVERED,

By PROFESSOR E. D. COPE,

AND

AN EXAMINATION OF TRACES OF DISEASE IN THE BONES,

By R. H. HARTE, M.D.

About two miles north of Cambridge, Dorchester County, Maryland, on the left bank of the Choptank estuary, a yellow bluff capped with dunes, known as Sandy Point, rises abruptly upon the bay.

The waves undermine the promontory, while the fierce wind, catching up streams of loose sand and tearing gullies in the dunes, whirls new drifts upon their leeward slope.

Thus the coast line recedes, and its transformation wrought almost visibly by wind and water fascinates the visitor, who, assailed by the prickly blast and ankle-deep in the talus, clambers along the steep escarpment, surprised to find that the shelterless bank is strewn with the relics of an Indian village.

Underfoot in the sand and where the bank slopes dangerously towards a chasm below, lie bits of charcoal, arrowheads,

burnt oyster shells, hammerstones, potsherds, and at one point numerous fragments of human bones; while on the beach forty feet below, the refuse continues to the margin of the waves. A detour along the chasm's brink and a steep descent lead to this strand, whence, looking upward, the visitor best sees the many-colored stratification of the cliff, and with it the true origin of the human rubbish.

Upon the cliff's foundation (a blue marl full of pecten shells) rests a layer of yellow and brown clay about 6 feet thick. Above this lies a band 2 to 3 feet thick of purple and black clay or marl, and next above, a stratum 20 feet thick of undisturbed yellow and white sand.

Upon this a clean-cut black stripe, 6 inches to 1 foot thick, the most conspicuous stratum in the bluff, extends horizontally right and left (see Fig. 31) as far as you see, and under the superincumbent mass of dune sand 25 feet thick that still rises above it.

The striking blackness of this stripe, as I learned when in January (2d to 9th), 1892, I examined it, resulted from its mixture with a dark loam peppered thick with the powdered charcoal of former fires; and when it appeared that all the Indian remains, including the bones first noticed, lay either in the black stripe, below it in the talus, or on the beach, and never above it, the inference was that all had fallen from it.

The black stratum, therefore, was the center of archaeological interest, and our questions were:

How far did it extend along the coast, and how far inland? How was its position to be accounted for? What had its contents to tell of a former human inhabitant? And finally, what was the true position, and what the significance, of the human bones?

1. The Extent and Character of the Black Stratum.

A day's work at a series of about ten pits in the talus at and near the outcropping of the black stratum proved the stripe, which was by no means densely scattered with man's relics, to be from 6 inches to 1 foot thick, to extend ⅓ of a mile along the bay-fronting crest of the cliff, and backward inland under the dunes 300–400 yards, where it thinned out in the lower level of the plateau behind. We found in it fire-fractured stones of hard sandstone or quartzite in five places, and pot-sherds of the coarse Algonkin type containing bits of powdered shell and quartzite in four places. Seven of these sherds were ornamented with incised lines, one was perforated, and five fabric-marked or in some way stippled. The layer yielded, besides jasper and white quartz flakes at several places, once a worked nucleus of jasper, four fragments of lignite, and one pitted white quartzite pebble hammerstone. Wherever we dug into it within 100 yards of the shore we found fine fragments of charcoal, all of which facts showed that the black stratum represented an earlier surface of the bluff. The top of the promontory had been the site of an Indian village whose fires and refuse had blackened the sand to the depth of one foot.

Heaps of new fallen talus and down-torn roots on the beach showed, as before remarked, that the sea was gradually encroaching upon the land.

The original bedding of the bluff had been heightened by about 20 to 30 feet of wind-drifted sand, and it was the behavior of this cliff-capping series of drifts or dunes, and the freaks of the wind with them, that at last explained the original topography of the place. Incessantly falling patches of sand on the sea face of the escarpment were lifted by the wind and borne inland to pile fresh buttresses against the leeward side of the dunes which, thus changing their contours by the leaping of grains from their out to their inside, and growing like

rolled snowballs, crept slowly backward over the land. Thus the black stratum beneath them, consumed by the process, wasted away, while its relics of stone and pottery fell into the sea.

The Indian village indicated by the black stratum had therefore occupied the stained area before that area had been encroached upon by the bay and overwhelmed by the dunes; and so entirely had the topography of the place changed that, what was now a steep water-front was once a level inland plateau well sheltered to windward by the sand bulwark of the dunes. (See Fig. 31.)

2. The Contents of the Black Stratum.

As might have been expected, masses of darkened sand, slidden down from the black stratum, covered the gentler slopes of the bluff below, and hid in many places the broad cliff-exposed lines of stratification.

This stained talus proclaimed the true contents of the black layer, for the heavier human relics borne down were winnowed free of sand by the wind, and showed thicker where the hollows caught them than anywhere in the black layer itself.

There was nothing among these exposed waifs of stone and earthenware to distinguish the remains from the usual handiwork of the North American Indian as seen at other riparian sites in the eastern United States, though it was interesting to find in the rubbish several discarded nuclei and waste chips of particolored jasper which, while fresh and keen edged, possessed ends and sides that were water rolled, thus demonstrating the origin of the fragments as parts of pebbles. The suggestion was important; and when soon after I found the bay shore just below strewn with similar pebbles of various sizes, not worked and in the natural state, a fact as yet unsuspected was clear. We had discovered a new Indian source for jasper

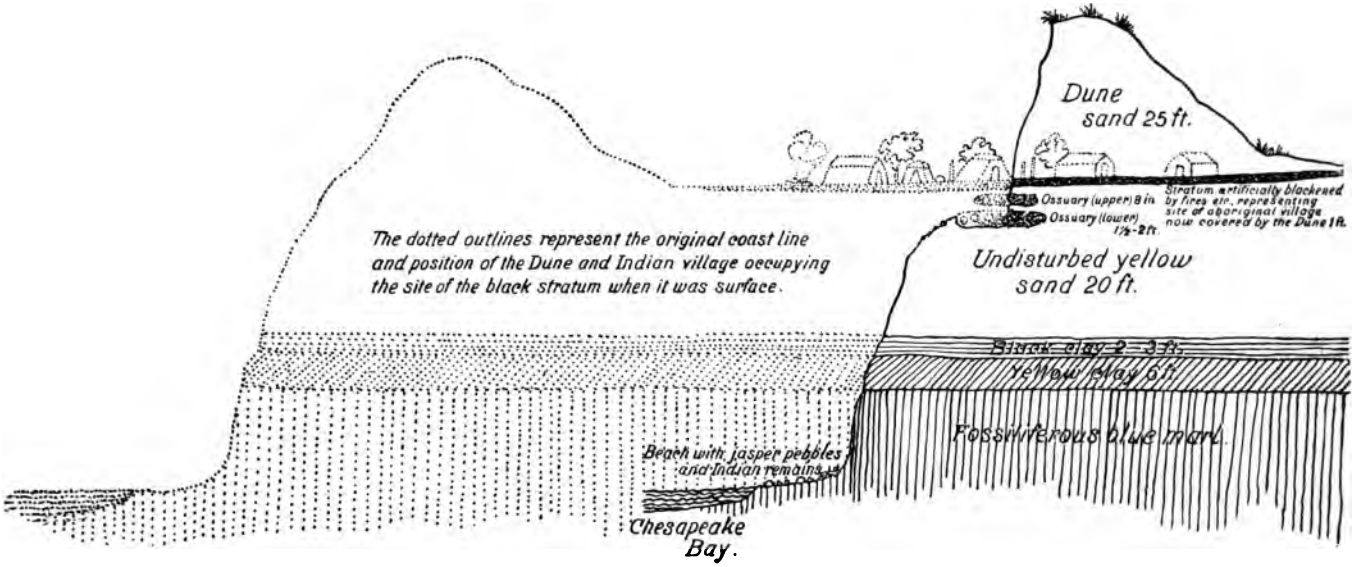


FIG. 31. — Sketch illustrating the present and probable past topography of the bay coast at the site of the Indian ossuaries at Sandy Point, Dorchester County, Maryland. The black outlines represent the present contour of the bluff, the dotted area its earlier configuration. Erosion proceeding inland has eaten away a part of the original village area, leaving only the portion marked by a thick black line. The old surface and ossuaries have thus been exposed in strata against the bluff's side, while a large wind drift of sand cresting the present cliff has covered the remaining area of the village site in recent times.

blade material east of the Alleghanies. In this case the old inhabitants of the bluff had not carried their jasper in ponderous loads from the aboriginal mines in the Lehigh hills 150 miles away,[1] but had gathered it in the shape of pebbles on the adjacent beaches.[2]

Such pebbles must needs have formed for a time the blade material of the first comer on the Atlantic coast, until the extensive outcrops of the native rock, referred to above, were discovered, while investigation shows that pebbles (of argillite, for instance, on the Delaware beaches) continued in use after bands of adepts had taken to excavating and working the native stone at the quarry sites, and hampers of blades more or less finished, and workable fragments had come to be carried as items of barter or commerce between tribe and tribe.

3. The Meaning of the Human Bones.

At a point on the bluff's face 300 yards up the estuary (measured along the black stratum, beginning at its lower, down-river end), and at that one point only, the talus below the stripe and about 30 feet below the dune's summit was sprinkled with decayed and broken fragments of human bones; and here the sand had been disturbed by previous digging done (as I learned from Mr. Hersey of Cambridge and George Marvel, the land-

[1] For accounts of the discovery and exploration of these native outcrops of jasper mined by Indians in the Lehigh Hills, see Popular Science Monthly, September, 1893, and American Anthropologist, January, 1894.

[2] I found similar worked jasper pebbles in May, 1892, matched as here by neighboring beach specimens and with chips to mate, at the so-called "Catawba" Indian village site, on the great Egg Harbor River, below May's Landing, Atlantic County, N. J. (See Proc. Am. Assoc. Adv. of Sci. Madison meeting, 1893, Anthropology.) Nevertheless, Prof. W. H. Holmes, who visited Choptank, searched for the ossuary, and should have walked on the beach in question, seems to have fallen into the error of supposing (Distribution of Stone Implements in the Tidewater Country, Am. Anthropologist, Jan., 1893, p. 8) that jasper was not at hand for blade-making in the tidewater region.

owner) about 1889–90 by expeditions in search of crania, from the Johns Hopkins University and the Bureau of Ethnology.

On Monday, January 4, I dug a trench 15 feet wide and 15 feet long into the talus at the spot. The labor was severe on account of the continual caving down of the bank that thickened above us as we proceeded, though by noon we had advanced into a thick deposit of human bones mixed with charcoal, bedded about 3 feet below the black village site stratum, and much disturbed as if by the digging above mentioned.

Before evening, however, all such trace of disturbance had ceased, and we had laid bare the true inner stratification of the bluff, reaching a hard-set horizontal bed of human bones and skulls, many of them well preserved, about 1½ – 2 feet thick, 10 feet long, 3 feet under the village site stratum, and running indefinitely into the bank (see Fig. 31). Evidently we had encountered a burial pit of some sort, and the questions were: How far did it continue under the bank? What did it contain? Who made it? What relation had it to the black stratum three feet above it?

Having faced the bone bed with a trench 2½ feet deep, so as to be able to undermine it and rescue the contents, we proceeded to shovel away the whole superincumbent mass of dune and bluff 25 feet thick above it, working on Tuesday and Wednesday with two men and on Thursday and Friday with four, until the entire ossuary was laid bare, and we stood upon a layer of human remains of irregular, circular shape, 25 feet in longest by 20 feet in shortest diameter and 1½ to 2 feet thick (thickest in the middle, and tapering at the sides).

Fortunately it had trended to the right rather than directly inwards as we advanced, thus enabling us to avoid the down-sliding of the thickest part of the dune; though, as it was, tons of sand fell, the slides occasionally bringing down masses 15 feet thick.

The excavation had disclosed the following facts.

a. TWO BONE DEPOSITS INSTEAD OF ONE.

After digging some distance inward, we had found, directly above the ossuary first encountered, another small bed of human bones, about 7 feet long, 8 inches thick, and 2 feet wide, separated from the former by about 1½ feet of sand. Its bones were generally intact in tolerable preservation, and in spite of the bits of scattered charcoal found with them, showed no direct signs of charring.

b. BONES CHARRED AND UNCHARRED.

In the main or lower deposit some of the bones had, others had not, been subjected to fire. The bone layer might have been subdivided thus: first, the bottom (6 inches), where the bones were in small fragments, blackened and bedded in masses of charcoal and ashes; second, the middle, next above (5 to 10 inches), where the skulls and bones, though somewhat charred, were intact; and third, the top (6 to 8 inches), where the bones, though mixed with bits of charcoal, showed no direct trace of fire.

The conditions proved that many skeletons had been burned in the lower part of the main bed.

c. THE RELATION OF THE BONE BEDS TO THE BLACK STRATUM.

The main or lower ossuary lay at a depth of 3 feet, the small upper deposit at a depth of 1 foot, below the black stratum; and that they were connected with the latter was to be inferred from the condition of the intervening yellow sand, which was slightly streaked with charcoal. The inhabitant of the black stratum when it was surface had, it appeared, dug a pit about 25 feet wide and 3–4 feet deep, at the bottom of which a fire or series of fires had been built. After many bones had

been thrown upon the fire and consumed, others cast down after it had smouldered had failed to burn or even scorch, at which point the pit had been filled with sand. The smaller deposit of bones (see Fig. 31) must have been either thrown in the hole when it was half full of sand or buried at the spot subsequently, since the absence of sufficient charcoal and ashes showed that no fire had been built under them.

Only after this could the clearly marked, black layer over both ossuaries have been formed, whether by the wind, drifting already blackened sand from neighboring areas over the spot — in which case the ossuary might have dated within or at the close of the village period — or by the slower sand-staining process of human habitation — in which case the ossuary must have been older than the village.

The surrounding coast country is subject to sand drifts; and had the bone pit been allowed to remain open for any considerable time, as for a long series of cremations at the same spot, it must needs have been hedged about with a fence or covered with a roof to account for the absence of drifted sand layers between the remains.

It seems more reasonable to suppose that the ossuary was made at once, after the fashion of the Iroquois, who Morgan says (League, 1851, p. 173), in times of public danger, or on migrating, heaped together the dried bones treasured by individual families, in a common burial-place.

d. NO TRINKETS WITH THE BONES.

No implement or trinket or object of human workmanship — save a single fire-fractured pebble — was found in either of the bone deposits.

e. NUMBER AND CHARACTER OF THE BONES.

Roughly speaking, the ossuaries must have contained the remains of at least 100 individuals, but no skeletons or parts of skeletons lay entire in either of the deposits. One cranium, referred to in the appended paper by Dr. R. M. Harte, of the University of Pennsylvania, and two others in less degree, seemed to show signs of syphilitic disease. What the skeletal remains have to indicate as to the size and condition of the people who buried them will be discussed in the following pages by Professor E. D. Cope. Sometimes the femurs, humeri, etc., seemed to lie in bunches, and the skulls might have been said to lie facing the east and south or face downwards, and but rarely turned towards the west.

Beyond this the bones lay helter skelter, and it was fair to infer that they had been dried and dislocated before deposition in the ossuaries, after the manner of the Choctaws (Bartram's Travels, 1791, p. 516), the Caribs (Gumilla Historia del Orinoco, I., pp. 199–204), the Iroquois (Morgan League, 1851, p. 173), and the Natchez (Jones, Antiq. of S. Indians, 1873, p. 105), who are said to have dried and cleaned the bones of their dead, before their final deposition in ossuaries. It is stated (Brinton, Lenape and their Legends, p. 23) that the Nanticokes carried cleaned human bones all the way from Maryland to be buried in an ossuary at Towanda, and Heckewelder states (Indian Nations, p. 92) that bands of them went from Wyoming and Chemenk to fetch back from Maryland badly smelling bundles of freshly scraped bones; and that he had himself seen them carrying such putrid loads between the years 1750 and 1760 through the streets of Bethlehem.

The Nanticokes, who occupied most of the eastern shore of Maryland in historic times, sold the tract including Sandy Hill to the whites in 1722 (see speech of Col. James Wallace, at Cambridge, Maryland, July 4, 1884), and it has been supposed

that soon after, some of them removed to a reservation near East New Market (Dorchester County, Maryland), where they died out about 1830. Others at various times ascended the Susquehanna to settle at the mouth of the Juniata, at Wyoming, at Towanda, and finally among the Iroquois in New York.

There is good reason, therefore, to suppose that the deposit was the work of Nanticokes, and no little ground for classing it with the remains of ossuary mounds likewise, perhaps, of Nanticoke origin, on the Susquehanna, several of which I visited in the summer of 1892, at Hummels Wharf, Liverpool, and Klemson's Island.[1]

Though we failed to find traces of white contact in the black stratum, we saw no ground for attributing great antiquity to the bone pits. The tribe may have made them at or about the time of white encroachment, towards the end of the seventeenth century, if not at the time of their migration, in 1722, when in either case motives for concealing the spot might well have existed.

SUMMARY.

To sum up, the facts noted show :

1st. That the black stratum of Sandy Hill, now being gradually destroyed by the advance of the water, represents the site of an Indian village which existed there when the bluff, capped by dunes, extended several hundred feet farther into the bay than now.

2d. It is certain that the Indian occupant of the village had

[1] I learned that the bones lay in complete disorder in the Susquehanna ossuaries; but it must be borne in mind that on the Susquehanna the deposits rested on the surface under conspicuous mounds, while those of Choptank had been buried three feet deep without surface token. A farmer told me that he had found "Indian pipes" at the Klemson's Island mound; and the mound on Duncan's Island, destroyed in 1840 in building the dam at the Juniata's mouth, is said (Watson's Annals of Philadelphia, II., p. 191) to have contained along with "hundreds of cartloads of human bones" many beads and trinkets. The Choptank ossuaries contained no human relic whatever.

found arrowhead material in the jasper pebbles of the neighboring beaches, and so need not on all occasions have resorted for jasper to the quarries in the Lehigh Hills 150 miles away.

3d. The ossuary must have been made by the village inhabitant, and its construction is in accord with the known mortuary customs of the Choctaws, Iroquois, Natchez, and Nanticokes. There could be no doubt that the bones discovered had been previously dried and separated from their flesh.

Moreover, the burden of evidence indicates that the deposit was the result of one act or ceremony which may have continued several days, and disposed of bones stored up for many years, rather than of a long series of ceremonial deposits of the prepared remains of individuals brought lot by lot as they died.

4th. The bones are inferably those of Nanticokes who occupied the site until 1722, and probably made the ossuary towards the end of the seventeenth century.

HENRY C. MERCER.

PHYSICAL CHARACTERS OF THE SKELETONS FOUND IN THE INDIAN OSSUARY ON THE CHOPTANK ESTUARY, MARYLAND.

BY E. D. COPE.

THE numerous parts of skeletons preserved indicate a people of good and normal proportions. The limb bones are of full length and are straight, and indicate ordinary muscular development. The crania, of which more or less considerable parts of thirty-two are in the collection, are of regular and symmetrical form, and indicate a rather handsome race. They vary from dolichocephalic to mesocephalic, and the occiput is not flattened as is so often the case with North American aborigines, but is full and prominent. The forehead is not retreating,

except in one instance, and is, as usual, fuller in females than in males. The curves are regular, and the curvature of the calvarium, both in the norma verticalis and in the norma lateralis, is convex and without angles or conspicuous tuberosities.

The following gives the detailed measurements and characters of the best preserved bones.

Crania.

Cephalic index. No. 9672, 73.1. No. 9674♀, 72.1. No. 9675♀, 77.7. No. 9678, 72.5. No. 9679, 75. No. 9680♀, 75.5. No. 9682, 77.38. No. 9683♀, 75.2. No. 9685, 75.6.

Fig. 32. — Male skull from the Choptank Ossuary. No. 9685 ♂.

No. 9692, 71.9. No. 9693, 77.7. No. 9695, 78.5. No. 9701, 74.4. Regarding .75 as the limit of dolichocephaly, six of the

thirteen crania are dolichocephalic, and five are mesocephalic, most of them of the longer type. The average of the thirteen crania is 75.12, or at about the line between dolichocephaly and mesocephaly.

Height index. No. 9672, 77.89. No. 9680♀, 77.84. No.

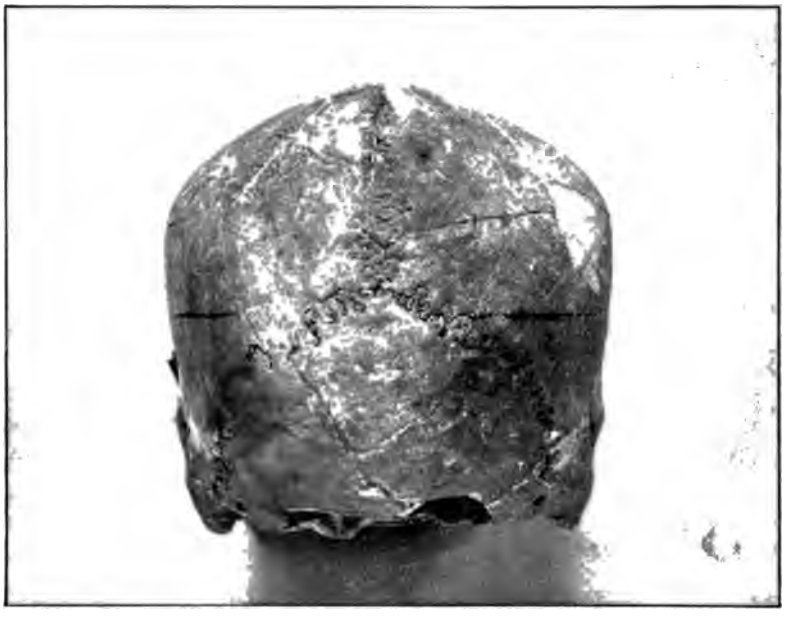


FIG. 33. — Male skull from the Choptank Ossuary. No. 9685 ♂.

9682, 70.2. No. 9685, 75.67. Of these No. 9682 is orthocephalic, and the others are hypsicephalic.

Upper facial index. No. 9685, 71. No. 9700, 68.8. Both of these exhibit the broad index. In the other crania the malar bones or the premaxillary border are too much broken for satisfactory measurements.

Orbital index. No. 9685, 82. No. 9700, 94.73. The difference in the orbits of these individuals is considerable, No. 9685 being mesoconchic, and No. 9700 hypsiconchic.

Nasal index. No. 9685, 46.3, or leptorhine; No. 9700, 58.1, just hyperplatyrhine.

Palatal index. No. 9700, 98.8, brachystaphyline.

Profile angle. Only one cranium was sufficiently well preserved to permit of accurate measurement. This one was apparently of average character, and gives an angle of 72°, and

FIG. 34. — Male skull from the Choptank Ossuary. No. 9685 ♂.

is therefore prognathous. In male skulls the supraorbital tuberosities are well developed. In a few instances they are not distinguishable on account of a general convexity of the glabella, so that their inner borders disappear; generally, however, they are more prominent than the glabellar region, and are bounded by a moderate concavity above. In only one cranium is the frontal convexity so slight as to give an appearance of marked retreat to the profile. In only one instance is an inca bone present.

Cranial capacity. Only one cranium (No. 9685) is sufficiently perfect at all points to permit of accurate measurement with small shot. This is a male. I selected the most

FIG. 35. — Male skull from the Choptank Ossuary. No. 9685 ♂.

perfect, and an average female skull, in which vacuities of the inferior wall were replaced with paper so as to represent as nearly as possible the normal form. The result is : No. 9685 ♂, 1500 ; No. 9680 ♀, 1320 cubic centimeters.

Dentition.

In no individual has the dentition of both jaws been definitely preserved, and in only two instances is that of the superior series sufficiently preserved to give a useful result. The results for

Fig. 36. — Male skull from the Choptank Ossuary. No. 9685 ♂.

both jaws are as follows. The numbers represent the tubercles of the true molars, the fractions expressing rudimentary conditions of the same.

9685, $\frac{4-4-?}{}$

9700, $\frac{4-3\frac{1}{2}-3.}{}$

9710 *a*, $\frac{\cdot\cdot}{5-4-5.}$

" *b*, $\frac{\cdot\cdot}{5-5-6.}$

" *c*, $\frac{}{5-5-6.}$

" *d*, $\frac{}{?-5-5.}$

MANDIBLE.

In all those preserved, the chin is normally developed, and the muscular insertions of the internal aspect of the symphysis are normal.

HUMERUS.

Of eleven humeri preserved, but two have perforated olecranar fossæ. An average example measures 366 mm.

FIG. 37. — Female skull from the Choptank Ossuary. No. 9680 ♀.

FEMUR.

In the various femora in the collection, none display anything exceptional. The linea asper is prominent and truncate. An average example (No. 9710) measures 518 mm.

TIBIA.

In the numerous tibiae obtained, the posterior face is strongly convex, so that the interosseous ridge is on the external side of the shaft. The section of the tibia is hence flattened so as

FIG. 38. — Female skull from the Choptank Ossuary. No. 9680 ♀.

to be moderately platycnemic. The measurements of three tibiae are as follows:

No. 1. At 240 mm. below proximal articular surfaces; long diameter 38 mm.; short diameter 21 mm.

No. 2. At 180 mm. below proximal articular aurfaces; long diameter 37 mm.; short diameter 21.5 mm.

No. 3. A. 240 mm. below proximal articular surfaces; long diameter 32; short diameter 22.

EXPLANATION OF FIGURES.

FIGS. 32–6; male, No. 9685. FIGS. 37–8; female, No. 9680.

TRACES OF DISEASE IN THE HUMAN REMAINS FOUND IN AN INDIAN OSSUARY ON THE CHOPTANK ESTUARY, MARYLAND.

By R. H. HARTE, M.D.

I have examined with great interest the relics of the human skull (see Fig. 39) exhumed from an ossuary on the shores of the Choptank Estuary.

Although the frontal left parietal and parts of the right temporal and parietal bones remain, thus constituting a fairly complete calvarium, many valuable indices of type are lost, owing to the absence of the face and base. From the expanse of its dome, width of its opheron, and the lack of a marked supra-mastoid ridge, however, I should judge that the skull was of a grade above that of the ordinary aboriginal; and that it originally possessed a cubical capacity equal, or nearly equal, to the medium type of European skull.

But the remarkable feature of this skull consists in a peculiar worm-eaten appearance, — a ravage apparently the result of rarifying ostitis, which has invaded the greater portion of the frontal and left parietal bones, and removed large parts of the outer table. Now bones which have long lain exposed to the elements — and particularly those interred in shallow sand beaches, where, after coming to the surface, they would be subjected to the attacks of wind-driven particles of sand, which attacks would in time wear through the compact substance and destroy large portions of the cancella — present a similar appearance. Similar conditions are found as the result of post-mortem changes. Moreover, the well-known manners and customs of the Indians of this region make it possible that a violent ostitis may have been provoked by some accident or injury. Hoping that the microscopic examination might

enlighten the subject, I asked my friend, Dr. Formad, to prepare two sections : one from a skull where great destructive changes had taken place as the result of syphilitic ostitis ; the other from the skull in question. A minute examination of the slides, however, failed to furnish us with any definite information. Nevertheless, I am convinced from the gross appear-

FIG. 39. — Indian skull, exhibiting marks of disease, exhumed in January, 1892, from an aboriginal burial pit or ossuary on the eastern shore of the Chesapeake Bay, near Dorchester, Maryland.

ance that, in the present instance, the changes occurred during the life of the individual, and are the result of acquired syphilis ; and that they would be considered, in any mortuary or pathological museum, as of syphilitic origin.

The antiquity of the specimen does not contra-indicate the existence of syphilis. The researches of Bruehl, Jones, and others have fortified the indications of prehistoric American syphilis ; and the evidences of its presence among the island

inhabitants of the New World are as significant and authentic as the proofs of its existence among the Chinese, Egyptians, and Greeks. Indeed, it is asserted by many of the older writers that Columbus' crew became infected with the disease, aud thus introduced it into Europe; and Ruy Diaz de Isla, a physician of Andalusia, asserts that he treated some of this company for syphilis, the symptoms of which had appeared among the crew before Spain was reached. The Mexicans, according to Bruehl, not only recognized the primary and consecutive manifestations of the malady, but even distinguished between its several types, and were so experienced in its management that they instructed the Spaniards how to deal with it. But whether the syphilis of to-day has or has not an American origin, there are proofs, as strong as any derived from the study of Egyptian papyri or from the famous document which Dabry discovered in Central Asia, of its existence in the New World before the advent of Europeans.

Although, therefore, the evidences of syphilis which this skull exhibits do not preclude the possibility of its being pre-Columbian, they by no means prove it to be so. The fact should not be overlooked that, though that region of America in which the relic was found has been the seat of a comparatively recent repopulation, yet it was early invaded by European traders. La Salle had founded a settlement on the banks of Illinois' principal river about the time that Penn landed on the Delaware, and rough soldiers and adventurers were already travelling from station to station by way of the line of forts which extended from Quebec, Macinaw, and Green Bay along the Mississippi. Under such conditions the spread of such a communicable disease as syphilis from Europeans among the Indians, whose moral standard was notoriously low, was probably rapid; and it is by no means certain that traces of it found in the most permanent portions of the body, exhumed after centuries, and in regions far beyond the borders of the

earliest white settlements, may not be of European origin. It is, moreover, true that the prevalence of this disease among the Indians increases in proportion to their intimacy with the white races.

The skull in question is undoubtedly of some antiquity, and manifests abnormal changes which are evidently due to syphilitic ostitis. Whether this infection is derived from a European or American source, it is, however, impossible to say.

AN EXPLORATION OF ABORIGINAL SHELL HEAPS REVEALING TRACES OF CANNIBALISM ON YORK RIVER, MAINE.

By HENRY C. MERCER.

York River,[1] an estuary of the Atlantic Ocean in southwestern Maine with a small fresh-water affluent, navigable by ships of light draught for about 4 miles, and for boats and canoes for 8, with a landlocked harbor, and extensive clam-banks daily bared at ebb tide, exhibits on both its shores, and for 2½ miles from the sea, a series of deposits of shells which on examination are found to contain charcoal, pieces of burnt stone, the bones of animals, and very rare fragments of pottery.

Like the Kjoekkenmoeddings of Scandinavia, and like the many other similar shell heaps that skirt the Atlantic coast from Nova Scotia to Panama,[2] these rubbish deposits represent

[1] In York County, on the extreme southwestern coast of Maine. The estuary, forming a small landlocked harbor of dangerous access, opens upon the sea about 9 miles north of the New Hampshire boundary and the mouth of the Piscataqua River.

[2] *At St. Margaret's Bay, Nova Scotia.* J. M. Jones: Forster's Prehistoric Races, p. 161.

Along the coasts of Maine and Massachusetts [containing elk, wild turkey, and great auk]. Professor Jeffries Wyman: Am. Naturalist, Vol. I., p. 560. [Cannibalism] Hardy: Peab. Mus. Rep. 1877, Vol. II., p. 197.

On Long Island. Elias Lewis, Jr.: Pop. Sci. Monthly, Vol. X., p. 436.

On the New Jersey coast. C. C. Abbott: Primitive Industry, Chap. XXX. [Heap 11 feet high, 25 feet long, 6 feet wide.] C. F. Woolley: Am. Antiquarian, Vol. I., p. 225. [Apparently sinking in the sea.] Prim. Industr., 446, 448. [The Keyport heap.] Described by Professor Rau upon the investigations of Dr. Samuel Lockwood. Smithson. Rep. 1864, p. 370.

On the Chesapeake shores. Lardner Vanuxem: Am. Ass. of Geologists and Naturalists, 1840–42, pp. 21–23.

the feasting sites of aboriginal Americans, who, having dug molluscs from the mud at low tide, built at chosen spots successive fires, where the flesh of animals killed in the chase was cooked with the molluscs, and bones and shells thrown in an ever-increasing pile under foot.

Archaeology asks what the contents of the shell heaps have to tell us of the habits and arts of the people who made them, and what antiquity should be assigned the heaps, judging from the age test of animal bones, mollusca, and human implements contained in them.

In the hope of answering these questions, I examined the York River heaps, some of which had probably never before been disturbed by white men, in the summer of 1891, and herewith take pleasure in acknowledging the kind assistance subsequently given me in identifying the animal remains and shells found, by Professor E. D. Cope and Professor H. A. Pilsbry, of the Academy of Natural Sciences of Philadelphia. The following were the results:

Group *A* (see chart, Fig. 40) consists of four heaps, 1, 2, 3, and 4, on the north side of a small inlet on the left river-bank, on J. Grant's farm, between the "2d" (driving) bridge from York to Portsmouth and the inlet at the mouth of the confluent from "Folly Pond." Heap 1 (diam. 15 ft., depth 6–8 in. in middle, 2–1 in. at sides) was covered with the typical 2–3 inch coating

At Cape Henlopen, Delaware. Leidy: Proc. Acad. Nat. Sciences, Phila., 1866.

On the Altamaha River. Lyell: Second Visit to the United States, Vol. I., p. 252.

On the Florida coasts [east coast]. Prof. Jeffries Wyman: Fresh-water shell heaps of the St. Johns River. Am. Naturalist, 1868. D. G. Brinton: Types of Mankind, p. 272, and Notes on the Floridian Peninsula. [Cannibalism.] Peab. Mus. Rep., Vol. I., p. 26. [St. Johns River heaps compared with the neighboring sand mounds.] Clarence B. Moore: Am. Naturalist, 1892–94; Journ. Acad. Nat. Sciences, Phila., Vol. X.

Along bayous near New Orleans. Forster's Prehistoric Races, p. 158.

American shell heaps in general. Prehistoric Fishing, by Charles Rau, Smithson. Contrib. to Knowledge, Vol. XXV., p. 259

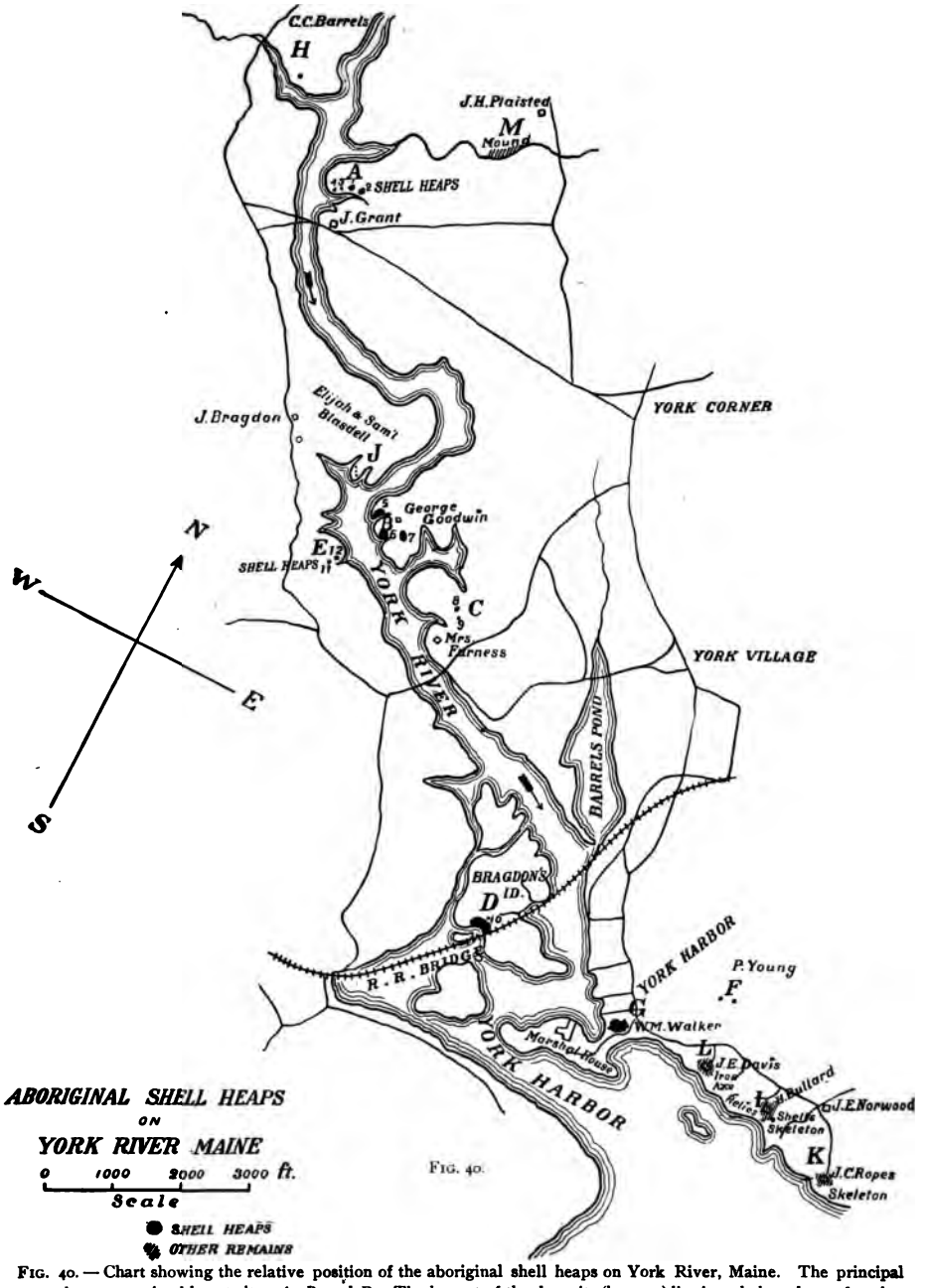


FIG. 40.

FIG. 40. — Chart showing the relative position of the aboriginal shell heaps on York River, Maine. The principal heaps examined lay at sites *A*, *B*, and *D*. The largest of the deposits (heap 10) lies in a sheltered cove fronting a large clam bed at *D*. The heap at *G* has been obliterated. Others at *C*, *E*, *F*, and *H* are of insignificant size. Most of the potsherds and bone implements were found at *D*. Traces of cannibalism occurred at site *B*, heap 6.

of tough sod through which the broken shells were easily visible, and consisted of a layer of broken clam-shells (*Mya arenaria* L.), fire-blackened and mixed with soil and fine pieces of charcoal, resting upon a thin substratum of ashes.

Mingled with the mass of crushed Mya shells, the main component of the heap, were a few sea-snail shells (*Natica heros* Say), called "wrinkles" by York fishermen, who use them for bait, together with the atlas, humerus, tibia astragalus, lower jaw with teeth, cannon bone, ulna, and naviculocuboid bones of the deer (*Cervus virginianus*), the right inferior sectorial tooth of the fox (*Vulpes*) or a small domestic dog, and the phalanx of a wild cat (*Lynx* sp.). With these lay several other bone fragments, unidentified, and often splintered as if for the purpose of extracting marrow, and a fragment 1½ inches square of coarse aboriginal pottery (see Fig. 41, object No. 4) half pierced with an artificial hole, now in the possession, together with the relics hereafter described, of the Archaeological Museum at the University of Pennsylvania.

Heap 2, not twenty feet to the east (diam. 20 ft. by 12 ft., depth 4–5 in. center, 1 to 1½ in. edges), contained shells, etc., as before, but no bones or relics.

Heap 3, ten feet west of heap 2 (diam. 10 ft., depth 6 in. center, 1 in. edges), contained, beside the ingredients of heap 2, two splintered fragments of bones.

Heap 4, fifty feet west of heap 3 (diam. 8 ft., depth 3 in. center to 1 in. edges), contained, besides the charcoal, shells and ashes; no bones or human relics.

The heaps in group *A* lay within a radius of one hundred yards of each other, all fronting the inlet toward the south, within two hundred yards of a spring at the head of the inlet, and near a large clam-bed at its mouth. All would have been well protected by forest growing on the bank behind them. Recent brush fires had been built on heaps 2 and 3, but beyond their new charcoal there were no traces of white men in

any heap. The landowner assured me that the rough pasture in which they lay had never been tilled, and judging from the surrounding sod, the compactness of the deposits, and the thinness of soil among the shells, it seemed improbable that the heaps had ever been disturbed by the modern inhabitants of the river. There was nothing in the shallow piles (only 6–8 inches thick, and which were homogeneous in character from bottom to top) to suggest layers denoting considerable time intervals or epochs of occupancy. Nor was there any reason for ascribing the existence of the heaps to any cause but the presence of small bands of North American Indians (evidently the makers of the piece of pottery found) in comparatively recent times.

The method of cooking appeared to have been of the simplest. I discovered no signs of holes lined with stones after the manner of the modern New England clam-bake, and no evidence of steaming with seaweed. The fragment of pottery indicated boiling in one instance, but all else inferred that the Indians had roasted the clams in the open flames.

Group *B* is on the left bank of the river, on G. Goodwin's farm, heaps 5 and 6 lying close to the water on the banks of small gullies, nearly opposite the rock known as "Sheepshead Rock."

Heap 5 (diam. 30 ft. x 15 ft., depth 1 ft. center to 3 in. edges), on the northern edge of a gully seven feet deep, contained, besides the usual shells of the soft-shelled clam (*Mya arenaria*), charcoal and ashes, fragments of pebbles broken by fire, the bones of the deer (*Cervus virginianus*), the remains of fish too small for identification, splintered bones of animals (unidentified), a granite pebble with battered corners that had been used as a "hammerstone," with slightly pecked indentations on its sides, a bone spear, or "harpoon" point, two inches long, with a single barb (see Fig. 41, object 5), a piece

FIG. 41 (× about 2/5). — Bones and shells (identified by Professors E. D. Cope and H. A. Pilsbry) and objects of human handiwork from the aboriginal shell heaps on York River, Maine. Deer, 6, 8, 9, 10, 11, 12, 13, 14, 16, 21, 25. Beaver, 18. Small mammal, 20. Sheep, 19. Carnivore, 22. Fox, 23 and 24. Catfish or salmon, 15. *Mactra solidissima* Dillw., 1. *Mya arenaria* L., 2. *Natica heros* Say, 3 (all small specimens). Aboriginal potsherd, 4. Glazed potsherd (white man), 7. Aboriginal bone harpoon, arrow, or spear, 5.

of glazed pottery made by white men (see Fig. 41, object 7), and a fragment of brick.

Heap 6, close to the river, is on the northern brink of the next gully below (five feet deep), at the head of which, not fifty feet away, is a spring. It lies about four hundred yards from heap 5 (diam. 25 ft. x 20 ft., depth 1 ft. to 3 in.). On digging it over very carefully with a manure fork and hoe, it was found to contain, besides the usual tokens of fire, shells and splintered bones, several fragments of fractured pebbles, three small aboriginal potsherds, one of which was fabric-marked (see Fig. 44, object 6), the point of a sharpened bone instrument (see Fig. 41, object 5), a piece of brick, and the bone of a deer (*Cervus virginianus*), split as if for the marrow. With these lay the following human bones (see Fig. 42), identified by Professor Cope: the lower end, a fragment about 4 inches long, of a right humerus, the proximal end of a right ulna (both fragments probably representing the arm of a small person or female), six fragments or splinters of the middle shaft of a right femur, fragments of the astragali of the right and left foot (both characterized by the concave surfaces known as Thompson's facets common in the astragali of savage peoples but not in civilized races, and which are held to be produced by the extra pressure upon the bone hinges when the ankle is bent down upon the instep, and hence to indicate the squatting habits of savages), the 4th and 5th metatarsals of a left foot, and the 4th metatarsal of a right foot.

Intentional Indian burial in the circumscribed diameter (25 ft.) and shallow depth of the heap would have interfered for a time with the feasting habit, while had the body of a man been buried at the spot the thin shell layer (1 ft. to 3 in. deep), which was examined over its full area, should have shown traces of interment.[1] The signs of a hole large enough for a

[1] At *I*, on the Norwood farm, a skeleton, buried in a sitting posture, was unearthed in the spring of 1891 while digging a drain. No implements or relics were

sitting burial (like that described later as seen near Stevens' store) would have appeared in the pure yellow clay scraped clean at all points under the shells, while any interment of a corpse or of a previously dried skeleton would have revealed more bones. The dislocated and scattered remains of two legs and one arm of a savage woman or boy could not have been intruded by white men, nor by the processes of their cultivation which had disturbed the shells. Sometimes broken as if with hammerstones for the purpose of extracting marrow (see Fig. 42), where, as in the femur, marrow existed, these splintered and disjointed bones, mixed with charcoal and ashes, the remains of the deer and molluscs feasted upon, reasonably indicated that human flesh had been cooked and eaten at the spot.

Heap 7, near by in the open field, two hundred yards from the river, had been largely removed by Mr. Goodwin for manure, and I did not examine it.

The heaps above described constituting group *B*, lying in old cultivated fields, had been disturbed by the plough and much mixed with the soil. The glazed potsherd and fragments of brick may have been stirred into heaps 5 and 6 with manure, while their original shape and depth may have been changed by grading the edges of the gullies. Nevertheless everything indicated that the human bones found were as certainly a part of the original rubbish at heap 6 as the animal remains discovered with them.

Heap 5 was within two hundred yards, heap 7 within one hundred yards, and heap 6 within fifty feet of a spring, and a very large clam-bed lay within easy reach of all. Heaps 5 and 6 front the water towards the south and east, even looking across

found near the bones. Very near were discovered the remains of a small shell heap. (Information received from Mr. J. E. Norwood, Sept. 1891.)

At *K* (J. C. Ropes' property), a skeleton, possibly not that of an Indian, was unearthed in digging the house-foundation, about 1886, and replaced by a superstitious workman.

FIG. 42 (actual size). — Human bones (metacarpals and fragments of femur and humerus), probably the remains of a woman or young person cooked and eaten by Indians, found associated with clam-shells, animal bones, and native pottery in an aboriginal shell heap (see chart, group *B*, heap 6) on York River, Maine, August, 1892.

the gullies in the same direction ; still, they would not have been protected in the rear from the north unless the low river-shore had been clothed with forest.[1]

Group *C*, on a rocky ridge three quarters of a mile down the river (left bank, near the head of an inlet and spring, behind the pine grove above the Sewall bridge), consists of two small heaps, heap 8 (diam. 10 ft., depth 1 ft. to 3 in.) containing, besides the usual shell ingredients, splintered bones and an oblong piece of sandstone, sharp on its entire circumference, possibly of artificial origin, the end of the calcaneum of the deer, and two tibiae of the otter or seal.

Heap 9, at the base of the ridge just below (diam. 2 ft.,

[1] Heap 6 had been slightly examined by Professor H. W. Haynes, of Boston, said Mr. Goodwin, about three years before. Mr. Goodwin had given him permission to dig in it with a trowel when the field was ploughed. Professor Haynes had not disturbed the old sod on the brink, and Mr. Goodwin thought that he worked only an hour, though with what results he did not know. While the present pages were printing (in August, 1896), the opportunity of a visit to York was seized to make doubly sure that no buried Indian skeleton had been dragged piecemeal into the heap by ploughing. I accordingly went over the deposit (heap 6) again, foot by foot, removing the sod, edging the shell layer with a trench, and scratching backwards all the shells with a manure fork as I advanced over an area 19 feet long by 14 feet wide, prolonged down the steep bank over an extra space 13 feet long by 4 feet broad. At all points the pure underlying and undisturbed clay was reached, and when pared clean with the shovel showed no sign of a grave hole. The following objects were found : a metatarsal bone of a young human being at a depth of about 5 inches, and 2–3 inches above the yellow clay, several small fragments of cracked bones (undetermined), the three fragments of Indian pottery mentioned above, no sign of which had appeared in the first search, the bone point referred to in the text (without a parallel in the first examination), and a broken tooth (undetermined). As remarked before, the deposit had been mixed, levelled, and extended by ploughing, though at the central deepest part, it revealed lowermost films of ashes that the ploughshare had never reached. The thickest part of the heap was about 8 feet inward from the edge of the bank and 14 feet inward from its corner fronting the river. Comparatively few shells were found under the sod on the slope of the bank, and at its bottom, where downslidden rubbish might have been expected to settle, too little sign of it was discovered to warrant much excavation there. Though the diameter (25 ft.) given above represented the limit of scattered shells, our excavation, 19 by 14 feet, seemed to fairly cover the area occupied by the original deposit.

depth 3 in.), contained charcoal, shells, and ashes, as usual, but no bones nor relics. Heaps 8 and 9 lay upon untillable pasture-land, and seemed never to have been disturbed by cultivation. Again, the small and shallow deposits, homogeneous from top to bottom, showed no sign of superposed layers denoting periods of visitation separated by considerable time intervals.

At *H*, on C. C. Barrels' farm, a small shell heap has been nearly obliterated by cultivation. At *J*, on the Blaisdell farm (right bank), on uncultivated pasture, are three small, very thin heaps, fronting the small bending creek to the southward. They average a diameter of 8 feet and a depth of 2–3 inches, and contain no bones nor relics. At *E*, in the wood on the right bank, on J. Bragdon's farm, fronting a narrow gully to the southeast, are two heaps, averaging 7 inches in depth and 6 feet in diameter, which I did not thoroughly examine. At *F*, in the swamp on the farm of Captain Peter Young, are two small heaps in the middle of a cart-track, averaging a diameter of 4 feet, with a depth of 3 inches, and containing only shells, ashes, and charcoal as usual.

About twenty heaps lying close together had been obliterated at *G* (in 1890) in grading for Mr. W. M. Walker's new cottages by Stevens' store, at which time (as I learned from Mr. Walker in September, 1891) the workmen found among the heaps a skeleton buried in a sitting posture, between several large stones ; and also, though not with the skeleton, a broken stone-scraper.

Heap 10 (at *D*), the largest deposit examined, rested on the southern and sheltered side of Bragdon's Island, fronting the conspicuous clam-bearing inlet bared at low tide near the York River's mouth. Eighty feet long, 20 feet wide at middle, thinning at the edges, with a depth of 32 inches on the side of bank, and 22 inches in the middle to 1 foot at the edges, it lay close to the ruins of a house and well, and had been much disturbed by white men. A recent and fresh-looking deposit of

shells, 30 feet long by 10 broad, and 2 feet deep in the middle, extended from the eastern end of what appeared to be its older portion, namely, that part of it which was covered with 3–4 inches to 1 foot of sod and loam, and of which the shells were entirely hidden.

Evidently, from the pieces of glazed pottery, fragments of brick and glass, pieces of iron, etc., scattered among splintered bones of recent animals throughout the new portion, and, as hereafter described, even in the old heap to within 8 inches of the bottom, the shells had been greatly rearranged by white men, who, finding an Indian heap at the spot, had deposited their shells and refuse upon it, made the new heap, and in building the house, digging the well, grading and cultivating the area, had mixed their rubbish with the older deposit, to a depth of 1–2 feet.

Beginning a little to the left (west) of the middle of the Cove front, I edged the heap by a transverse trench, 33 feet long, which exposed a deposit of crushed clam-shells and black earth 1½–2 feet thick, covered by a tough sod and resting on pure undisturbed yellow clay. When cleared out to the bottom so as to reveal the clay, the trench was widened to 8 feet, by first removing the sod and then taking off about 6 inches of disturbed shells. After unearthing, among these, numerous spikes and nails distorted by rust, and a number of glazed potsherds of varied color and pattern, I found, at various depths, several bones (often split as if for marrow) of the deer, the upper molar of the bison or domestic ox, the bones of a fish, the coracoid of a bird, the femur and tibia of a seal or otter, the jaw with teeth of a domestic hog, and the caudal vertebra of a domestic ruminant.

When we removed the lower zone of shells resting immediately above the clay, scratching them carefully back with manure forks, slight signs of disturbance were noticed towards the right (east) end of the trench (where fragments of a nail

and a piece of glazed pottery appeared to have penetrated into the shells for about 10 inches). Elsewhere, however, we saw no sign of the white man.

At the bottom of the old heap, I found, with several bone fragments, a number of "wrinkles" (*Natica heros*), with large solid shells of the *Mactra solidissima*, easily distinguishable from the smaller and more fragile soft-shelled clams (*Mya arenaria*), the chief product of the neighboring mud, and the main component of the heap. At this depth the shells, not only of the *Mya*, but also of the large *Mactra* and hard *Natica*, with which the fire-builders had varied their diet, were much better preserved than those nearer the top, and indicated that the heap-making had gone on quickly enough at first to protect, sometimes by interposed material, the lower shells from the crushing footsteps of the feasters.

In digging carefully through the mass of shells, which, though deeper than at the other heaps, again gave no clear sign of definition between layers, we laid bare in the lower zone described above several cracked deer bones with molars, astragali, calcanea, cuboides, phalanges, and one fragment of the jaw of a deer (*Cariacus virginianus*), two canine teeth of a black bear (*Ursus americanus*), and two canine teeth of the seal (*Phoca vitulina*).

The fragment of the lower jaw of a dog or wolf (*Canis sp.*) found near these bones (see Fig. 43) was in all reasonable probability a part of the refuse deposited by Indians during the earlier period of the foundation of the heap. Here again, therefore (though not for the first time in the shell heaps of Maine), is raised the interesting question of the relation of the domestic dog to native American peoples.

We say much to indicate the status of culture of the pre-Columbian American when we say that, ignorant of the goat, ass, sheep, cow, pig, or domestic fowl, he had lagged behind the later Stone Age people of Europe in the ingenious and use-

ful adaptation of animals to his daily needs. If he had neither seen nor tamed the American fossil horse (the Chinese *Fu Sang* account of a supposed discovery of America in the fifth century to the contrary),[1] the llama in South America and the dog in both continents seem to represent the only animals that he had contrived to domesticate.

As to the mere fact of his association with brutes more or less resembling the European dog there is evidence enough.

FIG. 43 (actual size). — Fragment of the lower jaw with teeth of a domesticated dog or wolf (*Canis sp.*), found in August, 1896, in the lower portion of the Bragdon's Island shell heap (see chart, site *D*, heap 10), York River, Maine.

The sledge dog, domesticated by the Eskimo, must have been familiar to certain northern Indian tribes before the coming of Columbus, and doubtless not a few early explorers, were their narratives examined,[2] would, like Cabeca de Vaca and de

[1] We are told in the Chinese narrative, first noticed by De Guignes in 1761 (Academy of Inscriptions, Vol. XXVIII., p. 506), that the people of the country *Fu Sang* (affirmed by some and denied by other students to have been Mexico), discovered by *Hwui Shan* and his party of Buddhist monks in 499 A.D. had the horse. See An Inglorious Columbus, by E. P. Vining, New York, 1885.

[2] A footnote to Nadaillac's Prehistoric America, New York, Putnam, 1884,

Soto,[1] testify to the existence of domesticated dogs among Indians before European dogs could have found their way into the wilderness.

When, however, we ask what species of dog had been so encountered by Europeans in the New World, whether such dogs were the descendants of dogs brought from Asia, whether they were artificially developed from wolves or coyotes, and, lastly, whether they were the offspring of indigenous older or fossil species, the information thus far presented is perplexing and unsatisfactory. Wyman found dog remains in shell heaps at Mt. Desert, Maine, and Eagle Hill and Cotuit Port, Massachusetts.[2] Dall found a skull in an Aleutian shell heap.[3] Moore discovered a jaw in the Econlockhatchee Creek shell heap in Florida[3]; another skull, referred to below, was unearthed in the large shell heap at Damariscotta, Maine; and I found dog bones in human culture layers in the caverns of Chekt-a-leh and Sabaka in Yucatan,[4] while several skeletal remains of dogs have been discovered buried with the dead in the ancient Peruvian Cemetery of Ancon. But having overcome the difficulty of proving a pre-Columbian date or significance for any given dog-like jaw or skull exhumed in America, the presentation of decisive evidence upon the subject is further beset by the close and perplexing resemblance between the bones of dogs and the bones of wolves, a resemblance so great, for

p. 4, in referring to the domestication of the prairie dog or coyote (*Canis latrans*) by Virginia Indians, and reciting a description (from an authority unnamed) of Virginia, published in 1649, quotes: "The wolf of Carolina is the dog of the (Virginia) woods. The Indians had no other curs before the Christians came amongst them. They are made domestic. They go in great droves in the night to hunt deer, which they do as well as the best pack of hounds."

[1] Narrative of Alvar Nunez Cabeca de Vaca, translated by Buckingham Smith, Washington, 1851, p. 41, cited, and de Soto referred to, by Mr. Clarence B. Moore, in Certain Shell Heaps of the St. John's River, Florida, hitherto unexplored, by Clarence Bloomfield Moore, American Naturalist, July, 1893, p. 613.

[2] American Naturalist, Vol. I., p. 560.

[3] American Naturalist, July, 1893, p. 613.

[4] Hill Caves of Yucatan, Lippincott, Philadelphia, 1895, pp. 69, 155.

instance, in the cases of the Newfoundland, the collie, and the St. Bernard, that distinction of the skulls is impossible. Under these circumstances I take pleasure in quoting a note upon the specimen in question from Professor E. D. Cope:

"The fragment of lower jaw with three premolar teeth (see Fig. 43) obtained by Mr. Mercer at York Harbor corresponds closely with the jaws of two dogs (one accompanied with skull) obtained by Mr. C. B. Moore from mounds in Florida. A skull with lower jaw of a dog from a shell heap at Damariscotta, Maine, submitted to me by Professor Putnam of Harvard University, presents the same characters. These jaws cannot be referred to wolves nor coyotes, but represent a different and probably domesticated animal. They are of rather smaller size than the wolf, the muzzles are relatively shorter, and the frontal region is more convex.[1] Mr. Moore believes the Florida dogs to be pre-Columbian. The same is probably true of the dogs found in Peruvian graves which have been described and figured by Dr. Nehring. Nehring shows that the domesticated dogs of the ancient Peruvians have no specific affinities with the native dogs of South America. The pre-Columbian dogs of North America resemble closely the Peruvian dog, regarded by Nehring as "resembling the sheep dog." It is possible that these dogs resulted from the domestication of the wolf, but it is also possible that they became the companions of man in the Old World, and migrated with the aborigines into America from Asia. It is probable, judging from their appearance, that some of the dogs of the existing western tribes were derived from both wolves and coyotes. It is believed with good reason that some of the dogs of civilized races were derived from wolves (the collie, the St. Bernard, etc.), while others were derived from the Asiatic and African jackals. Others, again, represent

[1] The ramus of lower jaw of a dog obtained by Mr. Moore in a Florida mound is figured in the American Naturalist, July, 1893, p. 613. It presents some special peculiarities not found in the jaws above referred to.

different species now extinct. Such was the opinion of Gervais, and his view is generally accepted (see Proceedings of Academy of Natural Sciences of Philadelphia, 1879, p. 17)."

As to the relation of American wolves to dogs, I am indebted to Dr. M. Klittke of Frankfurt-on-the-Oder (see Das neue Ausland, January, 1894, p. 20) for the following interesting quotation describing what appeared to the English sailors of Captain Richard Whitbourne's ship in 1615 as domesticated wolves among the now extinct Beothuk Indians of Newfoundland.

Whitbourne says (see Discourse and Discovery of Newfoundland, London, Felix Kingston, 1622, p. 2, conclusion):

"Also they (the Beothuk) are a people that will seeke to revenge any wrongs done unto them or their Woolves, as hath often appeared. For they mark their Woolves in the eares with several markes, as is used here in England on Sheepe and other beasts, which hath been likewise well approved. For the Woolves in these parts are not so violent and devouring as Woolves are in other Countries."

This is preceded (on page 8) by the following curious statement :

"In the year 1615 it was well known to 48 persons of my company and divers other men that three several times the Woolves and beasts of the country came down neare them to the seaside, where they were labouring about their Fish, howling and making a noise, so that at each time my Mastiffe-Dogge went unto them (as the like in that Country hath not been seen), when the one began to fawne and play with the other, and so went together into the Woods, and continued with them, every of these times, nine or ten dayes, and did returne to us without any hurt. Hereof I am no ways superstitious, yet it is something strange to me that the wilde beasts, being followed by a stern Mastiffe-Dogge, should grow to a familiarity with him, seeing their natures are repugnant."

With the bones of the dog, bear, deer, and seal above described, our minute search for aboriginal implements in the Bragdon's Island shell heap was scantily rewarded by finding a pebble hammerstone of light granite, and at a depth of 10 inches to 1 foot, a doubly barbed harpoon or spear point of bone (see Fig. 44, object 13). At about the same depth (see Fig. 44, objects 11, 12, 10, 9, 1, 2, 3, 4, 7, and 8), I found a bone needle, a fragment of bone artificially pointed, two bone splinters rubbed to a point, and twelve fragments of aboriginal pottery. The ware, black, coarse, and containing fragments of pounded quartz, resembled that (see Fig. 44, object 6, and Fig. 41, object 4) found in heaps 6 and 1, and in one instance (Fig. 44, object 8) showed signs either of the impact of a coarse fabric, or of scratching with a rude brush. Another piece (Fig. 44, object 2) suggested a coarse incised decoration. There was nothing novel or surprising in the make or design of the fragments found, and there could be no reasonable doubt that they were the handiwork of North American Indians whose fictile products, so common at village and feasting sites farther south, they in all respects resembled.

Notable facts in connection with the shell heaps are: that they invariably front the water to the south or east; that they lie conveniently near to clam-beds and water; that they all consist chiefly of shells of the edible soft-shelled clam (*Mya arenaria*), intermixed with charcoal and underlaid by ashes; that the splintered fragments of bone, which do not occur at all in certain heaps, are always in very small proportion to the shells. Their rarity might be expressed by saying that one bone was found to about two wheelbarrow loads of shells, or one in every ten minutes' hunting.

Had the clam-eaters often feasted on animal flesh, more bones must have escaped the fire by lying under the protecting edges of large stones often found imbedded in the clay and shells; but as these crevices rarely contained bones, it was

FIG. 44 (actual size). — Potsherds, bones sharpened to points, and harpoon or arrowhead from the York Harbor shell heaps, found in August, 1896. The sherds 1, 2, 3, 4, 7, and 8 are from heap 10; the sherd 6 and the bone point 5, from heap 6; the other bone objects are from heap 10. The pottery containing fragments of quartz is not distinguishable in make or decoration from the common Indian ware found elsewhere in New England and throughout the middle United States.

reasonable to infer a scanty animal diet at the sites. Not infrequently pebbles of various sizes were unearthed, which, though they presented no evidence of battering, had doubtless been brought to the heap by Indians, while with them lay fragments of hard stone weathered into blade-like forms, showing in spite of their convenient shapes, no sure signs of use.

Some of the heaps had been disturbed after their makers had abandoned them, as was shown by the occurrence of white man's relics mixed with splintered bones and Indian implements in heap 5, and mixed with splintered bones in heaps 6 and 10, though in no other heaps. The presence of charcoal and ashes always demonstrated the artificiality of the deposits, though no arrowhead nor polished stone implement was discovered anywhere ; and though aboriginal implements were extremely rare in the whole series, these were nevertheless found at groups *A*, *B*, *D*, and *G*, where the potsherds, pitted hammerstone, bone harpoons and points sufficiently indicated Indian handiwork.[1]

[1]The Norse oral traditions, called the Sagas of Eric the Red, and the Flatey book, antedating the fourteenth century, but not put in writing till then, upon which (and random mention of a place called Wineland in mediaeval Norse annals Codex Frisianus, Landnamabok, Kristni Saga, Saga of Olaf, Eyrbyggia Saga, and the so-called AM manuscript) the theory of pre-Columbian American discovery mainly rests, repeat accounts of a people called *Skrellings*. (See The Finding of Wineland the Good. A. M. Reeves. London, Henry Froude, 1895.) These littoral savages with skin boats, "swarthy, ill-looking, and ugly-haired, with great eyes and broad of cheek," at times encountered the exploring parties of Thorfinn, Karlsefni, Thorwald, and Lief Ericsson (along the northeast American coast) as they went to Wineland.

If the Skrellings were Eskimos, then Eskimos inhabited the American Atlantic shore in 1000 A.D., as far south as Wineland, and if Wineland (according to Horsford) is the Charles River valley, or (according to others) Cape Cod, Rhode Island, or any point farther south, then we might expect to find some of the bone carvings or other characteristic remains of the Eskimos anywhere along the coast of Maine, and not improbably in the shell heaps. In the York River instances, however, there appeared no reason for ascribing any of the objects found to other than Indian makers.

The simple bone points could not have been regarded as characteristic of any savage people, while the single and double-barbed harpoon or arrowheads, com-

That aborigines made the heaps is further proved by the fact that there are no relics of white men at *A*, *C*, *F*, or *J* (see Fig. 40); while where white men have been known to have disturbed the heaps, as at *B* and *D*, they have left relics of unmistakable character in the shells.

When we wonder that savages, whose successive feasts formed the deposits, managed to lose so few specimens of their handiwork among the shells or in their vicinity, where (except at *K*, *I*, and *L*) a number of farmers questioned by me, and fairly representing the region of the heaps, informed me that they never ploughed up Indian implements,[1] we are reminded that the heaps are comparatively small, and do not indicate a long enough occupancy to have necessitated the loss of many implements in the rubbish.

mon to both Indian and Eskimo, equally lacked cultural significance. If we omit the pitted hammerstone as peculiar to the Indian, the pottery would remain the only culture test. So closely did it resemble in make and design the ware of the North American Indian, common in New England, that under the circumstances it seemed superfluous to assign it to any one else. I have not compared it with the earthenware of the Alaskan Eskimo, and Professor Mason informs me that though the National Museum is well supplied with specimens of the latter, no pottery of the northeast coast Eskimos has come to his notice.

[1] At *M*, on J. H. Plaisted's farm, on the north bank of the brook that drains Folly Pond, about half a mile from its mouth, I found a slightly semicircular mound (100 ft. long, 10 ft. wide, 20–23 in. deep) of evidently artificial origin. On digging a hole in it, two feet square, I found it composed entirely of clay, but discovered no relics of man. "Local tradition," said Mr. Plaisted (who called it the "Indian Bank"), "referred its origin to the Indians, who were supposed to have built it as a 'blind for shooting wild ducks.'"

At *I* (Mrs. Bullard's property), workmen in grading (1890?) found a stone celt, or "plummet," so called. (Information received from Mrs. Bullard, September, 1891.)

At *L* (J. E. Davis' property), laborers in digging (spring of 1891) found a so-called tomahawk of iron. (Information received from Mr. Davis, September, 1891.)

Mr. F. Woodward, of Chase's Pond, reported the discovery of a broken stone pestle and three grooved stone axes, found in the course of many years in the neighborhood of the eastern end of the pond. A grooved stone axe was found on the Norwood farm by the father of the present (1896) Mr. Norwood.

As before mentioned, a broken celt was found by Mr. Walker on one of the shell heaps at *G*.

If, moreover, as is probable, the Indians, known makers of earthenware as they were, roasted rather than boiled their food, they would have required little pottery, and hence left small trace of it (allowing for the few exceptions) in the heaps.

The scattered human bones in heap 6, judged by the hollows in the astragali, are, in the opinion of Professor Cope, rather the remains of savages than of white men.

Accompanied by all the signs of cookery in the Indian kitchen refuse, though the latter had been disarranged by cultivation and white habitation, they could not, in my opinion, have been intruded by white men, while the absence of traces of burial at the site indicated that the builders of the heap were cannibals.[1]

[1] As opposed to this inference, we must weigh such statements as those of Captain Parry (cited by Lubbock, Prehistoric Times, p. 512), that among the Eskimos observed by him who buried their corpses at a shallow depth, dogs often dug up and devoured the bodies, scattering the bones (which were regarded with indifference by the Eskimos) among those of animals used for food near the huts. John Murdoch says (Point Barrow Eskimos, Rep., Bureau of Ethnology, 1887–88, p.425) that "most people do not seem troubled at the bodies of their relatives being disturbed by dogs and animals, though they sometimes, to avoid the desecration, raise the bodies on stages of driftwood." Dr. Benjamin Sharp informs me that he learned among the Alaskan Eskimos that unpopular individuals were sometimes killed by their associates, when the unburied bodies were devoured by dogs. He had also heard of cannibalism practised among a starving party of hunters. On the other hand, he testifies to a superstitious reverence for the dead among the Eskimos on both sides of Behring Strait, as when he learned that Lieutenant C. M. White, in 1894, built a cooking-fire of the wooden grave-furniture of a buried Eskimo, on which occasion the Eskimos of the party, waiting, according to custom, to partake of the meal furnished by the first fire-builder, refused to eat, and expected their host to die; and as when, utilizing this feeling of veneration, Mr. Barret, agent for the Alaska Company at Kayak, prevented the natives stealing his potatoes by burying a dead Eskimo in the potato-patch.

If dogs had carried human bones rifled from graves to the feasting sites of their masters on York River, the fragments of femurs found should have shown signs of gnawing, but we found no such marks upon any of the pieces. We may imagine many transporting agencies for the bodies of enemies killed near by, and left to the elements, or for isolated instances of imperfect burial; but when all is considered, there seems no good reason for distinguishing the meaning and presence of the human bones in the heaps in question from that of the other bones and shells found with them. One common cause best explains all the refuse.

Mr. Manly Hardy, in 1877, had found human bones in a shell heap on the south end of Great Deer Island, Penobscot Bay,[1] which, if they did not indicate the burial, Nanticoke fashion (see preceding paper), of human skeletons previously dried, dislocated, and pitched indiscriminately into a hole, referred to a cannibal feast at the spot. Professor Jeffries Wyman, in 1861, had fairly proved cannibalism on the southern seaboard by finding scattered human bones, along with the midden refuse, in ten shell heaps on the east Florida coast. I found evidences of it in the floor refuse at three caverns in Yucatan,[2] while the existence of the practice of eating human flesh among eastern North American Indians has been established by the evidence of early eye-witnesses. To infer it once again from testimony collected on the shores of a river in southern Maine is but to add a paragraph to a chapter already written.[3]

Homogeneous throughout and lacking signs of the superposition of layers (such as Major W. H. Dall says he noticed in similar deposits on the Aleutian Islands, and Professor Wyman speaks of at deposits at Crouch's Cove and Frenchman's Bay, Maine), I found nothing in the heaps to indicate a succession of aboriginal visitors. The remains of fish and of the deer, fox, wolf, or dog, wild-cat, bear, beaver, and seal, with those of the hog, ox, and a domestic ruminant, as kindly iden-

[1] Twenty or thirty arm and leg bones, a sternum and pelvis, two skulls, one with jaw lying upon it, and one with lower jaw missing, mixed in the shells with ashes and charcoal, and moose and beaver bones. He says that he found no vertebra nor ribs, but admits that he stopped digging while fresh bones were being exposed. (Peabody Museum Report, II., p. 197.)

[2] See Hill Caves of Yucatan by H. C. Mercer. Philadelphia, Lippincott, 1896, pp. 116, 131, 156, 159.

[3] Wyman cites as eye-witnesses of North American Indian cannibal feasts in the 17th century the Jesuits, Hennepin, DeVimont, Brebeuf, and Le Mercier, quoting from the narratives of travellers further evidence of cannibalism among the Iroquois, Algonkins, Miamis, Kickapoos; in Louisiana, Illinois, and on the northwest coast, among the Caribs, in northwest South America, in Mexico, in Terra del Fuego, along the Orinoco, in Florida, and in Guiana. (Peabody Museum Report, VII., p. 27.)

tified by Professor Cope, whether unearthed in the older or newer heaps or portions of heaps, were geologically modern, while the shells of *Mya arenaria* (still most abundant in the region), *Mactra solidissima* (not infrequent), and *Natica heros*[1] (the bait "wrinkle" still used by York fishermen) indicated no antiquity for the feasting sites.

There is nothing, generally speaking, in the make or character of the heaps to differentiate them from the whole range of similar deposits that fringe the Atlantic seaboard from Nova Scotia to Florida, and among which, though the constituent shells vary according to habitat, though some heaps contain, while others lack, pottery and stone relics, though some are much larger than others, while some even appear to be sinking in the sea (see footnote to page 1), none, in the writer's opinion, have been proved to indicate a greater antiquity, or earlier stage of human culture, than that represented by the Indian remains of the interior.

Some writers, recording their own observations or the statements of travellers as to the size of the American heaps,[2] do

[1] Major W. H. Dall (on "Succession in the Shell Heaps of the Aleutian Islands," Contrib. to N. A. Ethnology, Vol. I., Washington, 1877, pp. 41–91) produces evidence from these piles of sea-urchin (*Echinus*) shells, held to demonstrate the existence of three layers, denoting successive epochs of occupancy, called by him the Littoral (oldest), Fishing (middle), and Hunting (latest) periods.

Wyman (Am. Naturalist, Vol. I., p. 560) says that he found two layers in a heap at Crouch's Cove, and again in the deposit on an unnamed island in Frenchman's Bay, Maine.

Dr. Benjamin Sharp, of the Academy of Natural Sciences of Philadelphia, recently (1895) returned from Alaska, informs me as to the region on both sides of Behring Strait, north of the latitude of the Yukon River's mouth, that he had noticed no midden heaps forming around Eskimo huts, shells were exceedingly rare in the region, and all bones remaining from feasts were eaten, or used in making bone implements, — a condition which applied particularly to the Siberian coast, where, owing to the absence of driftwood, bone was unusually valuable.

[2] Moore says (American Naturalist, July, 1893) that Orange Mound, near Lake Harney, is 560 to 260 feet in diameter and 14 feet at highest, though the freshwater shells, interbedded with layers of sand and loam, appear to have been purposely piled up, and so do not count as a vertical accretion. Mulberry Mound,

not appear to have reckoned with the probabilities as to rapid accumulation of shells by hungry savages,[1] and the chances of scarcity of Stone Age relics per cubic yard in this kind of rubbish, while one at least, Dr. Brinton (Essays of an Americanist, Porter & Coates, Philadelphia, 1890, pp. 29, 30), seems to have been misled by narratives of visitors, who have alleged a superabundance of *fossil* (Pleistocene) shells in certain heaps,

he says (American Naturalist, January, 1893), another fresh-water shell heap, is 16 feet high, and Mount Taylor, another, 175 to 500 feet in diameter, is 27 feet high, though it does not appear that he dug to the bottom of it to be sure that no artificial pile of sand added to its height. Nadaillac (Prehistoric America, pp. 54–57, etc.) speaks of the Lake George (Florida) heap as covering 20 acres, and from 20 to 2 feet thick, and of the Turtle Mound, near Smyrna, Florida, as 30 feet high. Brinton says (notes on Floridian peninsula) that others are 40 feet high. Burton, quoted by Brinton, says that the Brazilian *sambaquis* are sometimes 100 feet high, while, according to Lyell, the St. Simon's Island (Georgia) heap is 10 acres in area, and from 5 to 10 feet deep. The principal mussel-shell heap at Shell Mound Station, on the Tennessee River, below Chattanooga, spoken of by Nadaillac as very ancient, examined by me on December 8, 1893, was found to be 5 feet deep at the thickest, by about 20 feet wide and 72 feet long, while its mystery as a monument of unknown antiquity vanished when it was found to contain bones of modern animals mixed with the usual stone relics characteristic of neighboring Indian village sites, and of the floor deposits of the Nickajack Cave in sight at the spot.

[1] Professor Rau (Prehistoric Fishing, Smithson. contributions, Vol. XXV., p. 259) quotes Mr. Ivan Petroff, who says that a family of three or four adult Aleuts, and as many children, leave a pile 1 foot or 18 inches thick of sea-urchin shells after a meal (and see Petroff, "Limit of Innuit Tribes on the Alaskan Coast," American Naturalist, 1882, p. 571). One-half bushel, or about two-thirds of a cubic foot, of soft-shell clams (*Mya arenaria*) is the average amount disposed of at a York Harbor clam-bake by about twenty or thirty well-fed moderns, who partake with delicacy. Many half-cooked molluscs are not eaten. If we allow 250 medium-sized oysters (*Ostraea virginiana*) or loose shells to a cubic foot, a man who eats 65 oysters at a meal (no uncommon feat, I learn, at "oyster bays," saloons, and country restaurants) would produce one cubic foot of shells in four days, or could cover an acre four feet deep (174,240 cubic feet) in 696,960 days, or 1909 and a fraction years. Four men could cover the acre in 478 years, while a band a hundred strong might do the work in 20 years. If 100 men only feasted at the heap for one month in a year they could do the work in 228 years, while if eating together for only one month in 10 years they might produce the deposit in 2280 years.

when no such ratio of extinct Pleistocene molluscs is known to conchology.[1]

Allowing for the slower formation of deposits of the easily crushed and packed soft-shelled clam, for the varying number and degrees of hunger and gluttony of the feasters, for the greater difficulty of obtaining edible molluscs in primitive times, for periods of desertion of the sites, for the waste of material, and for careless statements of travellers as to the size of the heaps (when we realize that hillocks under the shells may give a false idea of height, and that a dozen shafts sunk to the soil level in an acre's shell area might be needed to give us a true idea of the cubic contents), it is doubtful whether we are justified as yet in ascribing an antiquity of many thousands of years to the shell heaps of the Atlantic coast. Least of all could the size and contents of the York River deposits be cited as evidence of great age. Indian remains have been reported frequently from the Piscataqua Valley, but rarely from the region between Mount Agamenticus and the sea, where Pleistocene man, if we admit his existence, could not have deposited his remains in the soil during the presence of the glacier, and while the ice sheet intervened between his footsteps and solid earth. After an examination

[1] Dr. Brinton speaks of *sambaquis* Brazilian heaps sometimes more than 100 feet high, and sometimes containing "shells by no means all of modern type. Many are species now wholly extinct, or extinct in the locality," — facts which he regards as inferring an antiquity of thousands of years before our era, and proving that man existed at these sites in Pleistocene time. As opposed to this, and as setting limits for the first time, I believe, to speculations as to the fossil age of American shell heaps, Professor H. A. Pilsbry, Conchologist of the Academy of Natural Sciences of Philadelphia, has just informed me that not more than one to two per cent of Pleistocene shells are extinct in Brazil, and could have been found in any shell heap. He furthermore believes that not a single extinct *species* of mollusc has been found in the kitchen middens of Europe or America, having heard of the discovery (by Mr. Clarence B. Moore) of but a single extinct *sub-species* (*Vivipara georgiana altior*) in the shell fields of the St. John's River, Florida.

of the rockshelters at Folly Pond,[1] and a canvass of the adjacent coast country, where farmers report Indian relics as of great rarity, the shell heaps, geologically modern as they are, seem to present the only conspicuous traces of pre-Columbian human presence in the region.

Historically considered, however, the records of white settlement in the neighborhood present us with a reasonable date for the abandonment of clam-feasting at the sites by Indians. From 1641 onward the region of the lower York River (the "Town of York"), occupied by the principal heaps, was appropriated by English settlers, who organized a local government, and built the group of wooden houses sacked and burned by hostile Indians in 1692.[2] Under these conditions it is unreasonable to suppose that savages continued to resort to the clam-feasting sites long after 1652, when the settlers built a coast road and established a ferry across the river's mouth. We can therefore justly refer the later and upper accumulations of the heaps to a period not more modern than the latter half of the sixteenth century, while the lower portions may represent a time several centuries older.

[1] The two shelters at the upper end of Folly Pond, the "Sheep's Nunnery," on a hillside near its lower end, and the "Devil's Den," in the steep slope fronting Middle Pond, were examined by me on September 13, 1891. Though they appeared no less desirable as temporary halting-places than many other similar sites that have yielded human remains, none of their floors when trenched showed signs of aboriginal occupancy.

[2] See the Ancient City of Gorgeana and Modern Town of York, by George Alexander Emery. Boston, G. A. Emery, 1874.

THE DISCOVERY OF ABORIGINAL REMAINS AT A ROCKSHELTER IN THE DELAWARE VALLEY KNOWN AS THE INDIAN HOUSE.

By HENRY C. MERCER.

OFTEN used as a shelter by vagabonds on balmy summer nights, rarely seen under the shade of its overhanging trees by wandering anglers, the picturesque rockshelter known as the "Indian House," in northern Bucks County, Pennsylvania, had escaped the attention of curiosity seekers and ramblers in the habit of visiting the "Ringing Rocks," the "Stony Garden," "Durham Cave," and "The Haycock." Davis' History of Bucks County does not mention it, but the interesting observer, Mr. W. J. Buck, writes pleasingly of it in Local Sketches and Legends, p. 175. Learning of its existence first through this account, and visiting it twice alone, and once in company with Dr. Charles C. Abbott, I made the excavations on June 26 and September 25, 1891, and July 1, 1896, described in the following pages.

The majority of relic-bearing caves are fissures in limestone, said to be caused by the infiltration of water containing acids in solution; but this shelter (on the left bank of Tohickon Creek, about 2½ miles above the confluence of Haycock Creek, 11 miles above the Tohickon's mouth in the Delaware River, and 350 feet above the sea) was a product of erosion in New Red Sandstone, one of those cavities occasionally found along ravines exposing cliffs of argillaceous rock, where soft spots or bands have rotted away, leaving adjacent crusts of harder material to do service as walls and roof. Here the erosive sculpturing had gone on outside as well as inside the cavity,

FIG. 45. — The "Indian House," a rockshelter in the shale (New Red Sandstone) on the left bank of Tohickon Creek in northern Bucks County, Pennsylvania, containing traces of the presence of the white man and a culture layer representing the Indian. Explored in June and September, 1891, and July, 1896. Photographed July 1, 1896.

giving a sort of rude relief to the cave which had come to stand out from the rock wall after the manner of a dormer window upon a roof. (See Fig. 45.)

Behind the shelter a talus-covered bluff, 38 feet high, follows the stream for a hundred yards or more, and on ascending it you look backward from its top over a reach of meadows shut away against the north by a wall of trees clothing the slopes of Haycock Mountain. These are in part ancient woods that the forest-felling pioneer, hastening westward, left behind a century ago. Protected by a formidable bed of trap rocks that defies agriculture, the trunks wait until the destroyer, armed with steam and electricity, shall return. Meanwhile the quiet years pass peacefully over the scene, where a gray farmhouse and lofty barn, set close upon the green, mark the limit of the white man's encroachment upon the woods. There the whip-poor-will cries at evening and the western light, edging the leaves with color, streams down the slopes upon a soil thinly scattered with the arrowheads and jasper chips that testify to the past presence of the Indian.

In the heats of summer the rockshelter under the bluff, 6 feet wide at the entrance, 8 feet deep, and 11 feet high, cooled under its sombre umbrella of leaves, might well have tempted the houseless wanderer, while upon the fall of the leaf, when the autumnal sun warmed it in the morning, the drying cranny, floored with stone chips, would have held well the heat of flaming camp fires built across its entrance. The reasonable inference that the Indian had been a visitor at the shelter was soon demonstrated by our digging.

A trench about 2 feet wide, cut across the cave floor at the entrance, and a narrower one extended longitudinally backward to the rear wall (deepened finally on July 1, 1896, until the solid rock was reached at a depth of from 1 to 4½ feet), revealed a deposit of fine rock splinters, the residuum of the decomposition of the shale, and mixed with dark mould containing the

remains described below. I subdivided it into the following zones. *Layer 1* (2–4 inches thick), the upper zone of rock splinters, in which no trace of Indian disturbance was found. Near or upon the surface, however, we discovered two porcelain buttons, proving by evidence purely archaeological the presence of white men in the cave,[1] while testifying to the probability of the general proposition based on work thus far done in caverns and rockshelters, that all peoples inhabiting regions confronted by accessible and conspicuous caves have entered them and deposited culture-denoting traces on their floors.

Layer 2 (6–16 inches thick), the middle zone of rock splinters, showed the mass of decomposed shale chips more thickly mixed with earth. Together with scattered bits of charcoal, and traces of ashes betokening the former existence of fires, lay at various depths, though never deeper than about 20 inches below the surface, the following objects :

Five arrowheads, one of them broken, and one of the notched-stem pattern, made of jasper probably procured at the Durham outcrop of the native rock about 10 miles to the northeast. A rough chip of quartzite lying near a fragment of jasper, reddened doubtless by scorching (see Fig. 46, object 3), and which had probably formed part of a rough unworked lump of the raw material brought to the cave from Durham for blade-making. A piece of black chert pebble, reduced by flaking (see Fig. 46, object 4), had been probably brought for the same purpose from the Delaware River beaches, 6 miles to the east, where water-rolled chert is very abundant. Near by, a hard bluish slate pebble showed no signs of use, but a large oblong quartzite pebble, 4 inches in diameter, abraided on its periphery, had doubtless been used as a hammer, while a flat disc-like

[1] William Kramer, living at a distance of ¼ mile, whose house I visited on June 26, 1891, and who first conducted me to the rockshelter, had always heard it called the Indian Cave or House. He had seen vagabonds in it, and had heard that when a store was robbed near by, his neighbors had wished to break down the shelter as a dangerous rendezvous.

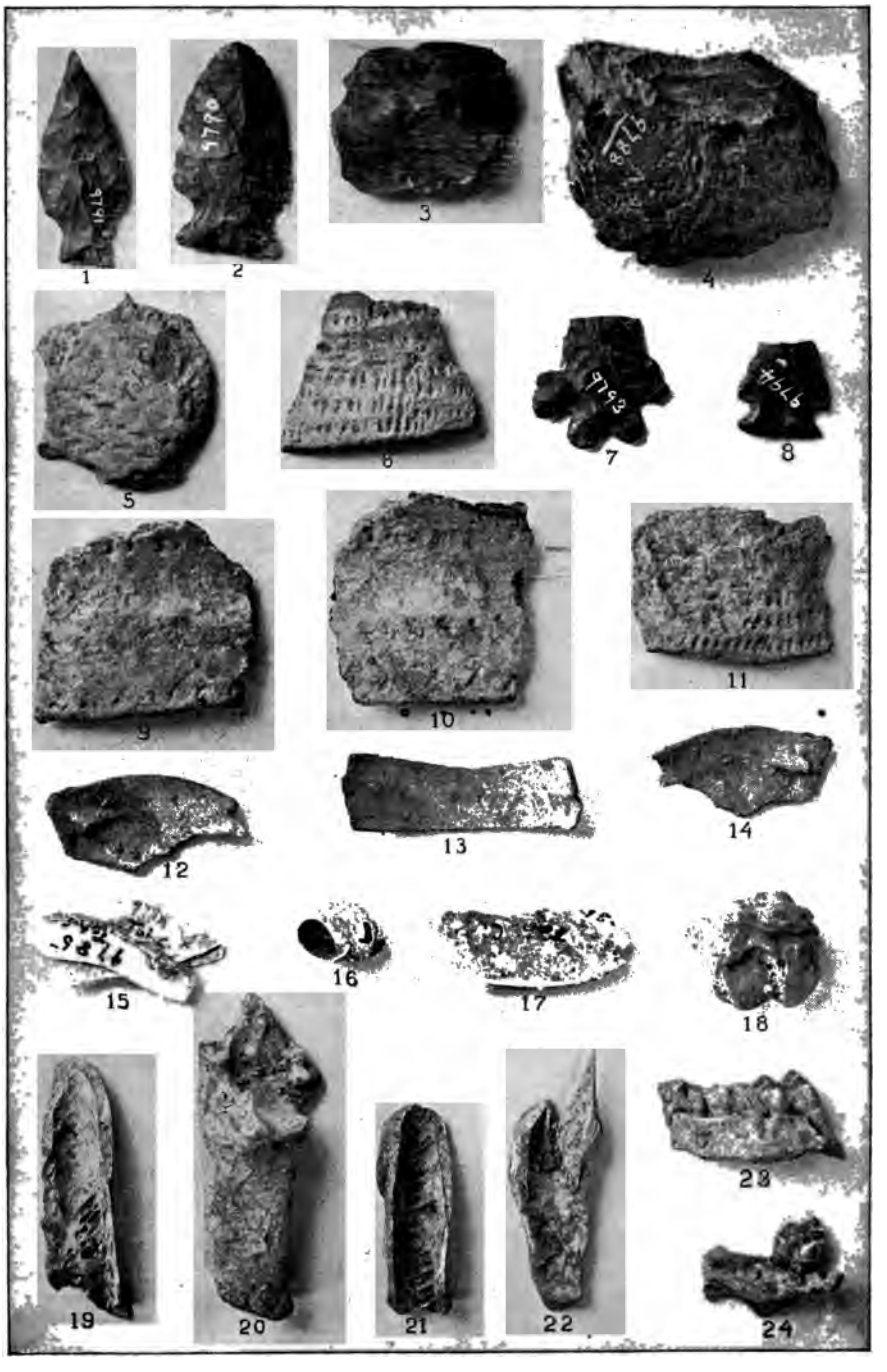


FIG. 46 (× 9/16). — Bones 18, 20 (19, 21, 22, split as if for the marrow; 23, 24, fragments of the jaw with teeth) of the deer; 12, 13, and 14, fragments of the carapaces of turtles; 15 and 17, pieces of mussel (*Unio*) shells; 16, snail shell; 5, 6, 9, 10, and 11, native potsherds; 1, 2, 7, and 8, jasper arrowheads; 3, jasper chip; and 4, fractured black chert pebble found associated with the remains of aboriginal fires in the floor earth of the "Indian House" rockshelter, June and September, 1891.

section of a round piece of sandstone may have done some indeterminable service in scraping.

No less familiar as objects of Indian handiwork than the arrowheads were about 18 potsherds of the common Delaware Valley pattern (see Fig. 46, objects 5, 6, 9, 10, and 11), averaging 1 to 2 inches in diameter, smooth inside, baked black or reddish brown with intermixed particles of pounded quartz. Some were decorated with the well-known zigzag of parallel incised lines, some stippled with blurred impressions that may have resulted from the impact of textiles, but none showed the stampings resulting from the pressure of wooden dyes characteristic of some of the ware found at the Indian village site of Lower Black's Eddy described in the preceding pages.

With these objects lay about 12 fragments of the shells of the fresh-water mussel (*Unio*) (see Fig. 46, objects 15 and 17), a piece of butternut, and (as kindly identified by Professor E. D. Cope) the femur of a squirrel, 7 fragments of the carapace of the land tortoise (see Fig. 46, objects 12, 13, and 14), and about 75 cracked bone fragments from ½–1½ inches long, together with fragments of the jaw, with teeth, of the deer (*Cariacus virginianus*). (See Fig. 46, objects 18, 19, 20, 21, 22, 23, and 24.)

That the bones upon which we failed to find traces of rodent gnawing represented, like the fragments of molluscs and turtles, the remains of creatures whose flesh had been cooked and eaten in the cave by men, there could be no question, while the familiar arrowheads and pottery established the identity of the cave visitor beyond a reasonable doubt.

The relics lay thicker just outside the shelter than inside, as if the savages had built the fires across the entrance and sat within; but there were no signs of prolonged occupation, and the scanty remains, as compared with the masses of human refuse formerly observed by me upon the floors of such European shelters as Laugerie Basse in the Vezere Valley, were

hardly noticeable. Vain was it to search among the potsherds and arrowheads for a hidden meaning, vain to refer the scanty relics to troglodytes, to a race of people dwelling in North America as the contemporaries of the Indian, yet distinct from him, or to assign them to an epoch or age in the history of man characterized by cave dwelling as a habit. What we had discovered revealed the casual presence of the familiar Indian — nothing more. Once or oftener taking shelter under the natural arch, he had feasted there upon the remains of mussels, turtles, and deer.

Nevertheless though there was nothing to distinguish the remains from the contents of the treasure-box of any boy collector of "Indian relics" in the neighborhood, the rock vault overshadowing the objects as they lay, and sheltering the associated bones from the ravages of weather, gave the spot a significance superior to that of the open-air Indian sites of the surrounding region. And it was this fact that has warranted the minuteness of the present recital.

We were digging in a house made ready for man possibly before his coming. That it had tempted the ingress of white man and Indian was proved. Nothing but further study and digging would decide whether its floor had felt or could have felt the footsteps of a still earlier people, who, finding it as the Indian had found it, had in like manner strewn its foothold with the residuum of fires, culture-telling products of handicraft, and the remains of animals killed, cooked, and eaten.

The existence of such a race in the Delaware Valley had been asserted by some and denied by other observers, and the chance of here finding collateral evidence bearing decisively upon the discussion, inspired us as we dug downward through the stone splinters. But the quick exposure of the rock floor at a depth of from 1–3½ feet dispelled our hopes in laying bare *Layer 3* (1–3 feet thick), the lower zone of rock splinters, a mass of stone chips and mould containing no relic of man

whatever, and resting on the outsloping rock floor at a depth of from 1 foot 6 inches to about 4 feet. Here, then, was a cave adapted for human shelter though small, in which earlier peoples, if they had existed in the region, had failed to leave their trace. But this portion of the evidence was negative, and its value was diminished by the facts :

(1) That the cave floor lying only about 7 feet above the average water level of Tohickon Creek, 63 feet away, was still flooded by freshets (as tufts of drift grass caught on neighboring trees showed) to a depth of 1 foot, and that therefore earlier culture layers, if they existed, may have been washed from its bottom.

(2) That the erosion of the soft shale, caused chiefly by frost, heat, and dampness, helped by a weather hole in the right wall and a cleavage crack along the roof, must have gone on rapidly at the spot. This probability was evidenced further by the mantle of post-Indian splinters (Layer 1) on the floor, not probably over 200 or 300 years old, and was attested by the present configuration of the neighboring shale buttresses, where similar shelters seemed to have been obliterated by the caving in of their roofs. These considerations would weigh in favor of the belief that the hollow as compared with average limestone caves was of modern age, and furnish ground for questioning the significance of the evidence exhumed. The advocate of man's great antiquity in the Delaware Valley might thus explain the absence of pre-Indian culture-traces in the shelter by urging the destruction of earlier testimony by freshets, the insignificant size and remote position of the cave, and its possible non-existence during the alleged earlier human period.

On the other hand, the discovery of Indian remains on the cave floor was positive evidence. We had found a culture layer, scanty but sufficiently characteristic to establish the identity of a cave visitor antedating the white man. As far as it went it positively represented the familiar Indian of the Delaware Val-

ley. But it had no subdivisions indicating a considerable lapse of time during its formation, while the presence in it of decorated pottery, the bones of the deer, tortoise, and squirrel in unfossilized condition, and the shallow depth of the objects, offered no suggestion of antiquity. We had found no trace of a cave inhabitant, rather of a hasty visitor, and the evidence worth recording showed that once or oftener the Red Man, within a time represented by the scope of a few centuries, taking casual shelter in the cave, had feasted there upon the flesh of the familiar turtle, deer, and mussel, captured in the neighboring wilderness.

AN EXPLORATION OF DURHAM CAVE, BUCKS COUNTY, PENNSYLVANIA, IN 1893.

BY HENRY C. MERCER.

INTRODUCTION.

THE end of a subterranean chamber (175 feet long by 50 broad and 21 to 28 feet high) opening upon a limestone quarry, close by the mouth of Durham Creek on the right bank of the Delaware River and surrounded by slag heaps, — a sight to fill the investigator with regret, — is all that is now (1893) left of the once celebrated Durham Cave. Most of its original roof has been destroyed by a process of blasting begun by the Durham Iron Company about 30 years ago.[1] A great chasm once noticed by workmen has been filled up, the remains of men and animals have disappeared, and we have to search old accounts and question quarrymen for a notion of the original cavern which consisted of three or four large high-roofed chambers, and must have been at least 280 feet long.[2]

As Rafinesque, who visited it in 1834, describes the single ingress looking eastward upon the river as "a shelving entrance

[1] This disastrous attack upon the limestone for lime-making in the kilns and ore-smelting in the neighboring Durham Furnace began, according to Mr. Laubach, in 1854; but Mr. Fackenthall, director of the furnace, who says that the site of the cave was bought by Mr. Joseph Whittaker for the company in 1847 and that the lime-kilns were not built before 1848, assures me that no internal disturbance was effected in the cave by blasting before 1866.

[2] Jacob Nichols, a workman who remembered the cave since 1825, told me in 1893 that the original entrance stood on the south side of the present slag track. He remembered a series of rooms running in many directions, and William Martin, who had come from Ireland in 1848 and was familiar with the cave before its destruction, further testified to the size and number of the underground rooms.

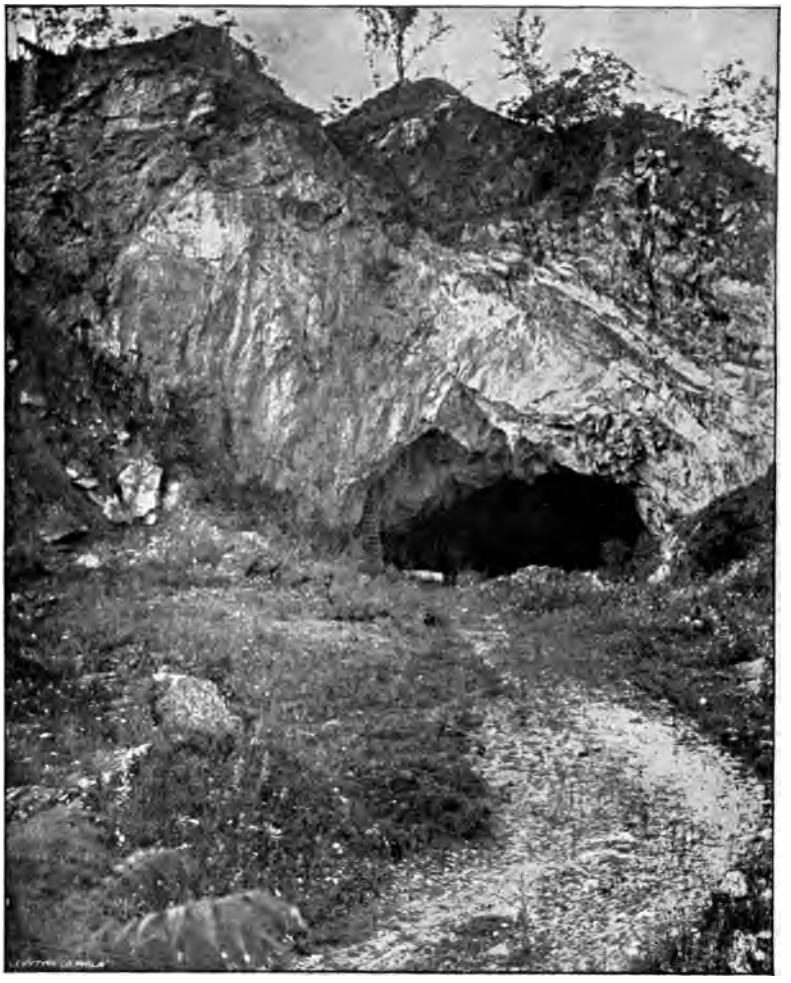


FIG. 47. — Durham Cave (right bank of the Delaware River, at the mouth of Durham Creek, Bucks County, Pennsylvania), as it appears in 1896. The open foreground indicates the area occupied by large chambers blasted away by the Durham Iron Company, the original entrance to which must have been somewhat nearer the observer than the extreme front of the foreground, or about 100 feet nearer than the present opening. The Delaware River is about 150 feet behind the observer. Photographed, July, 1896.

30 feet wide and 10 feet high,"[1] and as a writer in Hazard's Register (for March, 1828, Vol. I., p. 132)[2] speaks of a considerable enlargement, narrowing below into an entering rift broad enough to admit three persons abreast, the outermost chamber,

[1] Rafinesque speaks of it as extending inwards 300 yards. He says that it was not remarkable for any great wonder and contained no fossils, though he tells us that he only went a little way into it.

[2] His full description, given from a series of hasty and sometimes very incorrect guesses at the dimensions made on August 6 and October 12, 1802, is as follows: "The entrance into the grotto is about one hundred yards west of the Delaware River, and from one hundred and fifty to two hundred north from the point of land at the confluence of Durham Creek and said river. The height of the eminence enclosing the cavity is from two hundred to two hundred and thirty feet above the level of the circumjacent land. From the pathway of the entrance to the top of the rock above the measurement is upwards of forty feet. Three or four persons may easily enter abreast, but no more, as the mouth, though wide enough for admitting a great number, is rendered inaccessible by a ledge of rock running partly across. The cave is naturally divided into three grand apartments, into each of which out of the other the descent is steep, caused also by rocks prominent and jutting. After a descent of almost thirty feet the first apartment or chamber displays its greatest height and width, of which it is not an easy matter to form a true estimate on account of the irregularities in the vault occasioned by deep interstices and low dependent stone. A faint idea of its dimensions may, however, be formed from the following statement: first apartment, ninety feet long and averaging thirty-three feet wide and twenty feet high; second apartment, ninety-six feet long and averaging forty feet long and twenty feet high; third apartment, ninety-three feet long and averaging sixteen feet wide and seventeen feet high. Length of the whole cave to the water's edge at the bottom, 279 feet; breadth of the water, twenty feet. On October 12 the thermometer in the open air stood at 64°, but descended to 59° at the partition between the first and second apartments. Between the second and third apartments it sunk to 54°, which temperature it preserved throughout the whole innermost chamber. On August 5 the thermometer was very differently affected by the enveloped air, standing then in the open at 78° and at the lower end of the first chamber at 54°, but at the farther end of the lowermost rising to 62°.

"On some parts of the vault is a white parget, somewhat crystallized and probably a petrifaction composed of water exuded through the rock and calcareous matter. By the assistance of a hammer it is easily severed from the stone to which it adheres, some of it yielding to the pressure of the fingers. Over the parts of the arch there was another kind of incrustation dark in color, having the appearance of moss upon a tree, but as hard as the rock itself; over it water is continually trickling. The rock encompassing the cavern is entirely limestone, through which

which the latter writer says was 90 feet long by about 10 feet high, must have been to some extent light. If it was dry, as we may suppose from the surrounding drainage, it should have

in many places there is perpetual percolation of water. By supposition the descent in a right line forms an angle of 40° with the horizon.

"At the bottom a basin of excellent water, which measured twenty feet at the place where it came into contact with the rock, terminates the cave as far as it has been or can be explored. Beyond the meeting of the rock and water there is a conduit running farther into the earth than could be measured with a long pole, and this is undoubtedly continued, though it may ramify into many subordinate channels before it advances to the beds of the river and creek. The many springs on the verges, the proportionate rising and falling of the water contained in the cavern, with the flowing of the waters in the river and creek, demonstrate the connection of the subterranean waters with those outside, and prove the surface of the one to be on a level with that of the other. When there is a high freshet in the river the lowest chamber is nearly filled.

"At the partition between the first and second apartments a small branch of the cave, thirty-two feet in length and so wide as to permit in some places two persons to pass, takes a course in an easterly direction. From this branch lead two others still smaller, the one extending twenty-two feet north and the other in width admitting one person, continuing fourteen feet south."

Judging from the statements of workmen as to the position of the entrance, I guessed that it was 200 feet out from the present (1893) arch which, added to 135 feet for the remaining room, would make the original cave 335 feet long, though the above writer's length of 299 feet is probably correct. But Rafinesque's 300 yards is out of the question, as is also the length, about 150 feet, given by Davis. (See History of Bucks County, by W. W. H. Davis, p. 652.)

The present inner chamber may have been lengthened by blasting so as to permit the Hazard writer's estimate of its length of 93 + 20 = 113 feet to be correct, although it seems now to measure 135 feet without allowing for its destroyed outer end, while the present height, 21 to 28 feet just under the arch, diminishing to 10 feet at the water's edge, fairly corresponds with the average for height (17 feet) given in Hazard. Hazard's 300 yards to the river and 150 to 200 yards to the mouth of Durham Creek from the entrance, should be correct by my approximate measurements of 310 feet and 190 to 200 paces for these distances, respectively. But he is altogether wrong in saying that the cave hill, not seriously lowered by blasting, and which does not now measure above 90 feet in height (I found it 83 feet with a monocular level), could ever have been from 200 to 230 feet high.

In an examination made on March 27, 1896, when the river, swollen by rains, stood at a height of about 10 feet above its ordinary level, I found the cave pool at from 3 to 6 feet below the river level and that of Durham Creek. Both streams were muddy, while the cave water was clear, precluding the idea of immediate underground communication.

offered a desirable shelter to savages, thus fulfilling one of the first conditions of a cave shelter chosen for visitation by aborigines ill supplied with lights, and who in my experience in the eastern United States have not left evidence of their haltings in rooms that were dark.

Had the floors of Durham Cave been periodically overwhelmed by freshets of the Delaware, which, catching up the associated remains of men and animals, might have whirled away or hopelessly mixed the epoch-denoting layers, there would have been small use at any time in examining the cave earth for such evidence of man's antiquity as similar caverns have furnished in Europe. But the entrance to the cave must have been by my estimate about 25 to 30 feet above even the highest known freshet mark of 1841, so that another condition, that makes of a subterranean floor deposit an important palaeontological and human record, namely, permanency of environing conditions, was fulfilled.

A less public and conspicuous position (in one of the inland ravines to the westward, for instance) might have subtracted from the significance of the original shelter; but since its black doorway looking eastward over the river lawn from the slope of an isolated eminence, and set close upon the water, must have continually tempted the savage foot-wanderer — since, further, all passers-by following the river only 300 feet away, or halting at the mouth of Durham Creek, must have seen the cave, its situation satisfied another archaeological desideratum, namely, that of publicity and ease of access.[1]

These conditions leading the investigator to regard some caves as of much, and others as of little, significance would have warranted us in ascribing special importance to Durham

[1] To realize after investigation that the remains of Indians are more numerous and their village sites larger on the main stream than anywhere else in the Delaware Valley, is to suppose, not without reason, that the immediate shores of the river would have first and longest attracted the attention of any immigrant to the region.

Cave in its original and undisturbed condition, at least during the time within whose limits we venture as yet to speculate as to human presence in eastern North America, in other words, during that geological portion of the Pleistocene, in which man has been demonstrated to have existed in Europe, while the Delaware hills and valleys have been as they now are, and while we may suppose the cave to have held the same relative position to man that it held when the blasting began. If Pleistocene man existed at Trenton, he may well have ascended the river thirty miles, seen the cave, and entered it. If in the milleniums that are alleged to have intervened between his appearance and the discovery of America, any intermediate people, lower in the scale than the aborigines known later to white men, passed that way, the cave could not more easily have escaped their notice than it escaped that of the Lenni Lenape Indians, one of whose village sites confronted its entrance.[1]

[1] According to Mr. Charles Laubach, mounds, trails, clearings, and abundant fire-sites at the spot marked the position of the Indian village referred to in certain Pennsylvanian records of the seventeenth and eighteenth centuries as *Pechequeolin* (*Pechotwoallenk*, where there is a great depression in the land). Anthony Laubach, father of Charles, remembered stone-paved Indian fire-places set along the river margin in the alluvium extending from Riegelsville Bridge to the mouth of Durham Creek. The circular areas, raised about 12 or 18 inches, and about 6 feet in diameter, composed of burnt stones imbedded in ashes, did not extend in a straight line, but were irregularly disposed, and appeared to stop at a place seemingly devoted to the manufacture of arrowheads. Then, beginning again, they continued to the entrance of the cave. Seen first about 1812 they remained until 1841, when the great freshet for which that year was famous destroyed them all. The digging of the Delaware and Lackawanna Canal had previously obliterated a large portion of the village site with other fire-places. Cultivation continuing the work of destruction, finally completed it when three mounds on the top of the hill behind the cave, about 20 feet in diameter by 6 to 8 feet high and extending in alignment north and south, were ploughed down by William Walters in 1853–55.

Walters, who had measured before destroying them, had found or noticed nothing in them. An Indian trail had followed the right bank of Durham Creek for some distance inland along its ravine from which another trail, passing through an Indian clearing on the top of the hill above the cave, returned down the slope to the village. When Charles Laubach saw this clearing, — which remained surrounded by a forest as late as 1855, — it comprised about seven acres, and ran from

That the comparatively recent inhabitants of this village with their row of fire-sites along the river close by, with their mounds on the slopes behind, and beaten trail passing the cavern to ascend Durham Creek, must have paid frequent visits to the subterranean rooms ; and that they left traces of their presence on the floors there can be little doubt, while it is certain that bones of animals through various agencies had become scattered in and upon the cave earth, notwithstanding the statement of Rafinesque, who after a hasty look said that the cavern contained no fossils.

Mr. Laubach informs me that Professor H. D. Rogers, the state geologist, who examined the cave about 1856, found in it numerous Indian implements associated with animal bones, which former specimens, on being afterward sent to Dr. Swift at Easton, were burned in a fire at Pardee Hall ; while Professor Rogers says (Geology of Pennsylvania, by H. D. Rogers, Vol. I., p. 231) : "This cave was found many years ago to contain some interesting fossil bones, an account of which will be found in another chapter."

east to south in longest diameter. Both in the clearing and close to the neighboring three mounds, grooved stone axes were found, while at a point some distance up the river and close to the present Morgantown Road, Mr. Laubach remembers having seen from twelve to fifteen standing stones, the survivors of a group of about twenty-five formerly observed by Mr. Walters, all of which save one about 3 feet high, now remaining as a boundary mark by the Morgantown roadside and seen by me in 1893, were afterwards used to build the wall of a neighboring barnyard.

The monoliths must have been carried to the spot by Indians, since the rock *in situ* is limestone, and the Potsdam sandstone of which they consisted does not occur within two miles of the place. Earlier villages may have been overwhelmed by freshets at the site of *Pechequeolin*, according to Mr. Laubach, who says that he discovered arrowheads deeply buried in the alluvium after its exposure by the 1841 freshet; or, according to workmen who tell of a pipe discovered six feet below the surface in a sand pit. Two skeletons interred with beads were found near the river two feet under the sand at the upper end of the site in 1868–70.

A band of Shawnees, who had been quartered with the Delawares, left the Durham site, according to Mr. Laubach, in 1728, except a small remnant who remained upon Brandywine Creek, a tributary of Durham Creek, until 1780.

What became of these fossils we fail to learn from Professor Rogers, who never mentions them again in his two volumes; but if, as Mr. Laubach alleges, he sent them to the Academy of Natural Sciences of Philadelphia, some of them at least are represented in a list of animal remains from Durham Cave found afterward at the Academy and identified by Dr. Joseph Leidy as those of

Black bear	*Ursus americanus*
Raccoon	*Procyon lotor*
Gray fox	*Vulpes cinereoargentatus*
Skunk	*Mephitis mephitica*
Woodchuck	*Arctomys monax*
Porcupine	*Erethizon dorsatus*
Beaver	*Castor fiber*
Muskrat	*Fiber zibethicus*
Gray squirrel	*Sciurus carolinensis*
Wood rat	*Neotoma floridana*
Gray rabbit	*Lepus sylvaticus*
Deer	*Cervus virginianus*
Elk	*Cervus canadensis*
Moose	*Alces americanus*
Wild turkey	*Meleagris gallopavo*
Box turtle	*Cistudo clausa*
Snapper	*Chelydra serpentina*
Snake	*Eutaenia sirtalis*
Sturgeon	*Acipenser sturio*
Catfish	*Amiurus atrarius.*[1]

Whether this list represents all the specimens collected by Professor Rogers or not, Mr. Laubach has learned that, besides

[1] Mr. Laubach informs me that several boxes of bones gathered in the cave by Professor Rogers (marked "Durham Bone Cave, H. D. Rogers") were sent to the Academy of Natural Sciences of Philadelphia from Durham about 1845–55. All or some of these boxes were doubtless discovered by Dr. Joseph Leidy, who, after ransacking the cellar or museum of the Academy in 1887, appended to a paper on Hartmans' Cave (see Fossils in Caves, by Professor Joseph Leidy, Pennsylvania Geological Survey, 1887, p. 1) the above list of the remains of 20 vertebrata representing "a small collection of bones" contained in the museum of the Academy, "presented about forty years ago, but of which I can find no record."

the bones above referred to and sent to the Academy, others were subsequently found during the demolition of the cavern by workmen. I remember when a boy noticing several on the cave floor while one of the later alchambers was partly intact, about 1873, and heard from workmen in 1893 that human remains (suggestive of cave burial) had been found in smaller fissures. At the latter date Robert Barnet, who had seen the cave before its destruction, told me that he remembered the bones, horns, and teeth of animals lying on the surface in the cave, so exposed to the view of visitors that they were frequently carried off as curiosities.

Such were the probabilities in favor of supposing a considerable deposit of human and animal remains to have existed on the original cave floor that it seemed worth while, notwithstanding the fact that two-thirds of the rock walls and roof had been blasted away, to cut through the mantle of downfallen débris now overspreading the former cavern area, so as to lay bare if possible the old subterranean accumulations where they were most significant. But the attempt failed.

A Search for the Original Cave Floor.

How nearly the newly blasted faces of the walls of the amphitheatre coincided with the outer limit of the original chamber walls, it was impossible to say, since by all accounts the arrangement of rooms had been quite irregular, and no water-worn surfaces remained to suggest the previous contours. Neither was it easy to guess the true position of the former floors if they existed, since the thick mantle above mentioned of rock splinters and clay, which had dropped from above when the roofs fell, covered the larger part of the area once occupied by the subterranean rooms. Furthermore, as many parts of any cave floor are unavailable for digging, owing to dampness, slope, fissures, and relation to light and passages, it remained to

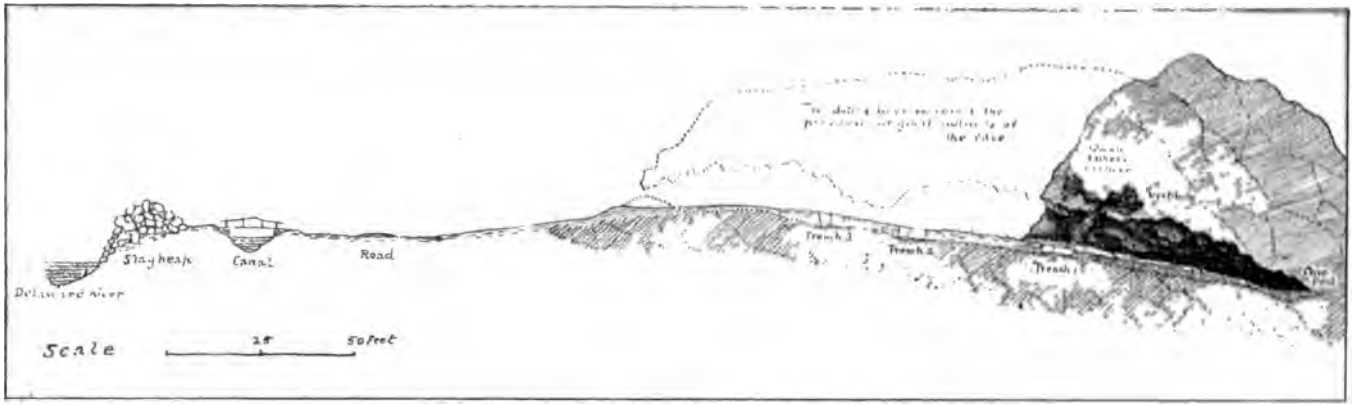


FIG. 48. — Diagram representing the present and probable original configuration of Durham Cave (right bank of Delaware River, at the mouth of Durham Creek, Bucks County, Pennsylvania), showing the position of Queen Esther's Chamber, where the bones of the extinct peccary were found associated with the remains of modern animals, and the site of our trenches dug in search of culture layers in the floor area of the original chambers. The dotted lines include the original portion of the cave destroyed by blasting. Explored in September, 1893.

be seen whether a reasonable number of trenches sunk through the rubbish would reveal the buried evidence we sought. Joseph Nicholas, one of the quarrymen, said that the cave floors were blown up, though he had not seen it done, while William Cyphers, also present at the blasting, denied their destruction, a statement seemingly corroborated by our own excavation of three trenches through the rubbish (see Fig. 48): (1) 20 feet long by 2 feet 10 inches wide by 4–6 feet deep; (2) 14 feet long by 4½–5 feet wide by 7 feet 3–5 inches deep; (3) 7 feet long by 2 feet 10 inches wide by 7 feet 7 inches deep; at distances of 90, 175, and 222 feet east of the margin of the cave pool, noticed in the above quoted account from Hazard covering the inner lower end of the remaining chamber. The water-worn ledge revealed at the bottom of each trench, and evidently the original rock bottom of the cavern, showed no signs of blasting, but the hardness of the superincumbent rubbish and its depth, with the cost and difficulty of removing it, induced me to desist on the completion of the third trench.

The conditions in all three excavations were unsatisfactory. A hard-caked mass of recent quarry rubbish mixed with bits of coal slag, and here and there fragments of animal bones (elk, carnivore (?), gray fox, wood mouse, porcupine, and squirrel), 7 feet 7 inches deep in the third trench, 7 feet 3–5 inches in the second, about 3½ feet thick in the first, rested upon whatever represented the original foothold of the cave. In the third trench no deposit was clearly found to intervene between the rubbish and the solid water-worn ledge on which it lay, so that we reasonably inferred either that the original cave earth on the ledge had been removed during the blasting, or, as seemed more likely, that we had reached a bare rock slope or level where no earth had ever accumulated. In the second trench no clear line of demarcation or conspicuous variance in the character of the rubbish indicated the existence of an underplaced layer, though to the original foothold probably belonged

a few quartzite pebbles lying close to the surface of the rock, and which may have been brought into the cavern by Indians or washed in by the higher Post-Glacial freshets. In the first trench, however, a layer of original cave earth lay upon the rock floor and under the rubbish. It contained the following bones, kindly identified by Professor Cope : the upper incisor and various bones of the wood mouse, *Peromyscus* (at a depth of 5 feet 4 inches); the radius (at 6 feet 10 inches), femur (at 3 feet 3 inches), and upper incisor (at 4 feet) of the porcupine, *Erethizon dorsatus;* two femora (at 6 feet), a tibia, and metatarsal (at 7 feet) of the rabbit, *Lepus;* and the rib (at 5 feet 4 inches) of a snake (undetermined).

As it pertained to what must have been a dark and damp inner room of the cave, this layer did not surprise us by containing no trace of the hearths and ash-bands that would have denoted the haltings of early man at the spot. Thus the true floor deposit that appeared absent in the outer two trenches, when found in the inner, was insignificant and at the wrong end of the cavern, while the scanty remains of animals scattered in it by whatever agencies, and lacking certain signs of human association, represented modern species and suggested no new estimate for man's antiquity.[1]

[1] The detailed description of these trenches is as follows: TRENCH 1, 2 feet long by 2 feet 10 inches wide, was sunk at a spot just under the rock arch and about 96 feet outside the margin of a pool of water above described at the base of the cave. This revealed first *Layer 1* of down-fallen rubbish and splinters, 2 feet deep inside to 3 feet 7 inches deep outside, sprinkled towards the bottom with the small bones of bats. Next came *Layer 2* of reddish clay about 2 feet thick, somewhat disturbed towards the top and containing the bones of the wood mouse, squirrel, porcupine, rabbit, and snake described above. Notwithstanding the disturbance which characterized the top of this clay, it appeared that our search had been rewarded at the outset by discovering in it a portion of the original floor deposit; nevertheless the fact was of little real importance, and when we considered that the place examined must have represented the soil of the wettest, darkest, and least inhabitable portion of the cave, some part of the lowermost chamber probably subject to overflows of the cave pool, there was little reason to be surprised that no trace of charcoal or ashes, no relic of human handiwork, gave evidence

that man had halted and built fires at the spot. Below the clay the pick-axes clanged on a solid ledge of limestone opening within the area of the trench into a narrow fissure with rounded sides into which the clay containing bones continued. Where this narrowed to a breadth of about 8 inches at a depth of about 6 feet from the top of the trench, we stopped digging.

TRENCH 2, 6 feet long by 4 feet wide and 175 feet out from the margin of the cave pool, showed *Layer 1* a disturbed mass of clay and limestone splinters, continuing from the surface of the ground to a ledge of solid rock at a depth of 6 feet. Several fine bits of coal sprinkled through this rubbish gave clear evidence of its recent disturbance. That much of it had fallen down from the original outer surface of the hill, and that it had been considerably mixed and moved during the process of blasting, there could be little doubt. Two feet down in it was found a fragment of the horn of an elk, *Cervus canadensis* (see Fig. 50, object 22), much gnawed by animals, about 2¼ inches long by 1¾ in diameter, with the softer bone inside removed for about ½ inch, suggesting in its shape the bone haftings of stone blades found in the Swiss Lake dwellings. Resting upon the rock bottom we found several quartzite pebbles from 1½–3 inches in diameter, whose presence was not easy to account for. Had they been brought into the cave by Indians for the purpose of blade-chipping, some of them would doubtless have shown abrasions upon their sides; but neither such traces of use, nor the stainings or scorchings sometimes characteristic of pebbles found about the fire-sites of savages and inferably used for cracking marrow bones, were found upon any of them. Though it was possible that they had fallen with the débris from the top of the eminence, we failed to find similar pebbles upon the outer surface of portions of the hill not yet disturbed by blasting, and it seemed more reasonable to suppose that Glacial freshets had washed them inside the rock arch.[1]

The hard-caked rubbish yielding grudgingly to the blows of the pick-axe, and appearing generally homogeneous from top to bottom, had revealed no line of subdivision upon its exposed face to warrant our supposing that even its lower portion, containing the pebbles above referred to, constituted an original and undisturbed, if non-relic-bearing, portion of the cave floor.

Disappointed at the result, we tried again, sinking TRENCH 3 (7 feet long by 2 feet 10 inches wide) in line with the other two, and following the original axis of the cave, as we guessed at it, at a point 222 feet out from the edge of the pool. Here again the disturbed rubbish, clay, limestone fragments, bits of coal, and loam, continuing down without an apparent break, rested on a ledge of seemingly water-worn rock, the probable bottom of the cave, at a depth of 7 feet 6–7 inches. The hard digging disclosed the tibia (at 6 feet 2 inches) of a carnivore unidentified, and the tibia (at 6 feet 3 inches) of the gray fox, probably *Vulpes cinereoargentatus*. But as little could be inferred from these specimens, we thought it wise to desist.

[1] Mr. R. W. Raymond of the Durham Iron Company informed me that in a colliery near Wilkesbarre a mass of rock splinters produced by blasting in one of the galleries had been rolled into pebble form after the passage had been subjected to the action of rushing water in a year and a half; but these pebbles being of quartzite, not limestone, were not original constituents of the cave, and must have come from a distance.

Excavation of Queen Esther's Chamber.[1]

A hole in the roof close under the left end of the remaining arch and reached by a step-ladder (at a point where a ledge conducting to it had been destroyed by blasting) led by a sharp turn on the left (east) to a steep, upward passage 13 feet long by 1 foot 3 inches broad and 7–10 feet high at the entrance, broadening with irregular walls to about 7 feet inside, and then contracting at its extremity to a crevice 2 feet 10 inches wide, but of ample height. This opened into the so-called Queen Esther's Chamber, an irregular room (see Fig. 49) about 14 feet wide by 12 feet in diameter by 8 feet 7 inches in height at the highest part of its irregular crevassed roof. The soft, mealy, cave earth bedding its floor, when gathered in handfuls, revealed in the candle-light an admixture of particles of charcoal, and when cleaned out entirely showed walls trending together into a V-shaped cavity, where the west wall sloped east at a sharp angle to meet the perpendicular east face. The roof was somewhat blackened with smoke, and one of its several irregular indentations communicated with a particularly black fissure about 8 inches in diameter, under which, on burning a newspaper, a strong draught of the flames into it, indicated its occasional service as a chimney. As the place, save for a few

Not only had we failed at three points to discover clearly marked culture layers upon the cave floor, but in no instance had our work revealed certain signs of ancient human occupancy. Though we had reached original portions of the rock floor uninjured by blasting, our efforts had probably been directed at points too far from the entrance, too damp originally, or too dark to have served as the chosen halting-places of aboriginal cave visitors.

[1] Probably recently named after the half-breed reputed daughter of one of the French governors of Canada, Catherine Montour, called Queen Esther, who exercised a controlling influence among the Susquehanna Indians during the Revolution, and who has been supposed (see Hollister's History of the Lackawanna Valley, p. 170), but perhaps without good reason (see Sherman Day's Historical Collections of Pennsylvania, p. 144), to have presided over the killing of white prisoners by Indians after the battle of Wyoming in 1778.

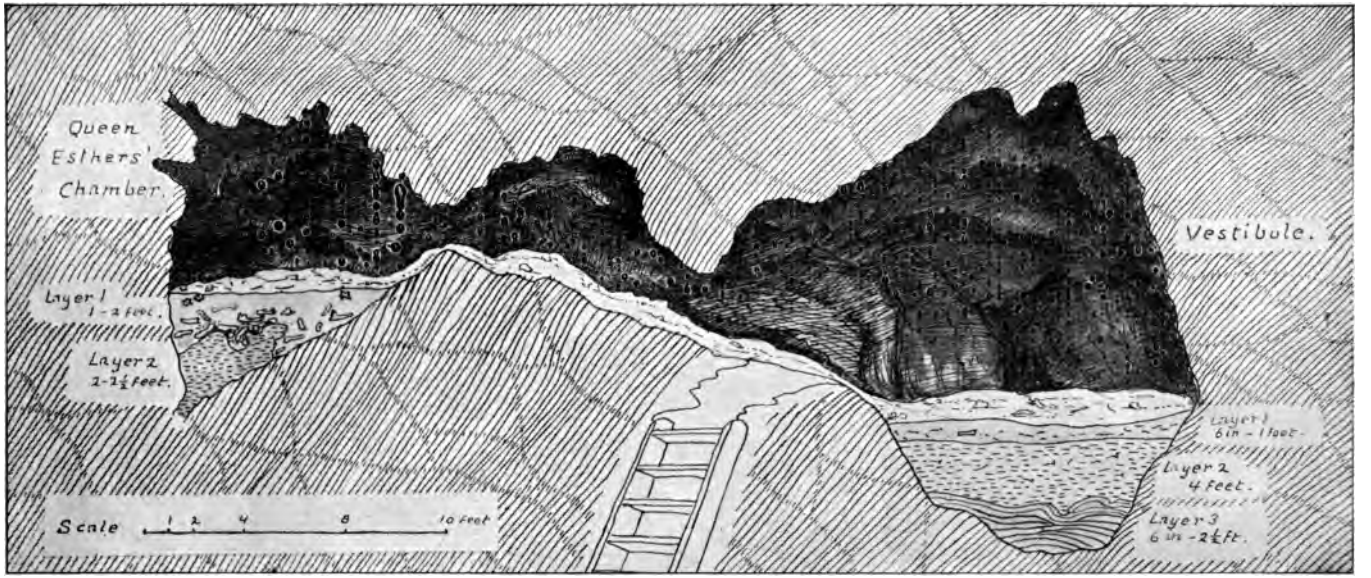


FIG. 49. — Queen Esther's Chamber and its vestibule at Durham Cave, Bucks County, Pennsylvania. The drawing shows the site of the discovery of the bones of the extinct peccary, associated with the remains of modern animals, in the cave earth, whose subdivisions are represented as they were exposed by excavation in September, 1893. The animal bones, often showing the marks of gnawing teeth, had probably in many cases been carried from their original positions in other parts of the cave to these inner recesses by rodents and carnivores.

rays of daylight at the entering crevice, was dark, candles were necessary at the digging, when the removal of the cave earth revealed the following layers :

Layer 1 (1 foot to 2 feet thick), consisting of soft brown cave mould comparatively dry and containing bits of charcoal and pieces of decayed wood, showed evidence of small fires recently built about its surface. Near its bottom we encountered a darkened deposit containing intermixed pieces of charcoal, 7 fragments of rotten wood from 2–4 inches long, and a store of 7 butternuts and 3 walnuts gnawed by animals (see Fig. 50, objects 1 and 2). Three of the wood fragments were charred, and one 3½ inches long showing the bark on one side revealed a cut across the grain at one end, which, as compared with my remembrance of the marks of stone blades on the sharpened billets found in the Indian jasper mines at Macungie, Lehigh County, Pennsylvania, and the broken-off staves made by Indians in the Wyandotte Cave, Crawford County, Indiana, looked like the result of a chopping blow with a metal axe or hatchet. At various depths in this layer (in the left (north) corner at about 2 feet 6 inches) were found upwards of 90 fragments from 1 to 4 inches long of the bones of animals, sometimes split as if by feasting savages for the purpose of extracting the marrow, sometimes scorched, and sometimes gnawed by animals (see Fig. 50, objects 17, 18, 19, and 20). The specimens identified by Professor Cope consisted of a humerus fibula and astragalus (gnawed) of the beaver, *Castor fiber;* the pharyngeal bone of the chub, *Semotilus;* the pectoral spine of the catfish, *Amiurus;* the lower jaw with two molars (see Fig. 50, object 9), a scapula, two humeri, an ulna, an ilium, and two ischia of the porcupine, *Erethizon dorsatus;* the sacrum and pelvis of the rabbit, *Lepus;* the canine tooth and lower sectorial molar (see Fig. 50, objects 4 and 5) of the black bear, *Ursus americanus;* the temporal bone, a part of the zygoma (gnawed), a piece of humerus (split and gnawed),

and an ilium (gnawed), together with about 50 undescribed fragments of the bones of the deer, *Cariacus virginianus;* a gnawed metacarpal of the wild cat, *Lynx rufus;* the lumbar vertebra of a carnivore (undetermined); the skull bones of the grouse, *Bonasa;* a piece of the carapace of the tortoise, *Cistudo* (see Fig. 50, object 7); two humeri, two femora, a tibio-fibula, and ulno-radius of a large frog, *Rana;* and the tibio-fibula of a small frog, *Rana.* With these remains lay two vertebra (of young animals) and part of the mandible (much gnawed) of the peccary, *Mylohyus pennsylvanicus* (see Fig. 51). As in the case of the other larger bones, it seemed reasonable to suppose that these fragments had been carried to the spot by rodents, while there was nothing to indicate that the animal had died where we found its remains. It was as to the age of these that the evidence spoke most conclusively. Of a light yellow color, and no less modern in appearance than the deer bones found with them, the interesting jaw and vertebrae presented no evidence of antiquity.

Just as many of the surrounding deer bones (some of which had probably been split for marrow by the Indians) showed marks of the gnawing teeth of rodents, so the peccary's jaw had been similarly gnawed, when still retaining its animal juices.

Other remains, referred to later, of the deer, porcupine, and beaver lay deeper than those of the peccary, and in an older subdivision (Layer 2) of the cave earth, while the jaw and vertebrae belonged to a superficial accumulation, which, beginning under the present conditions of the cave, was still forming. Whether the animal had or had not made part of an Indian feast in one of the outer chambers, whether it had come to the cave to die, or met its fate at the hands of man or beast, the evidence failed to show, but that it had existed as a contemporary of the modern deer, bear, porcupine, beaver, wild-cat, squirrel, grouse, and rattlesnake found with it, there could be

FIG. 50 (× $\frac{1}{4}$). — Bones of the (4 and 5) black bear, (6) wild-cat, (22) elk, (17, 19, 20) deer, (9, 10, 11) porcupine, (18, 21) beaver, (14, 15, 16) rabbit, (7) land tortoise, and (scattered) bat, found associated with the remains of the *extinct peccary (Mylohyus pennsylvanicus)* in Queen Esther's Chamber, Durham Cave, September, 1893.

no doubt. Reasonably to be regarded as a survival from, not as a representative of, an older time, it was proved modern by its association, and under the circumstances, though no evidence appeared to prove its contemporaneity with man, the probability cannot be denied that the Indian encountered or could have encountered it in the Delaware Valley.

The shells kindly identified by Professor H. A. Pilsbury (except the small mussel, *Unio complanatus*, perforated doubtless accidentally with a small hole) were all those of snails, many of which, though good for food, had probably found their own way into the cave. Close to the surface lay *Pyramidula alternata* Say, *Polygyra albolabris* Say, while at undetermined depths we found *Physa heterstropha* Say, and two species of *Lymnaea catascopium* Say. With them, in the same layer, spinkled about the surface and at various depths were unearthed numerous bones of bats (see Fig. 50, scattered upon the background), as to which I owe my thanks to Dr. Harrison Allen, of the Academy of Natural Sciences, who has kindly identified the series as belonging to two still existing species common in caverns, and of which I have obtained characteristic remains in the floor deposits of various caves in Tennessee, hereafter to be described. Dr. Allen determines two skulls (see Fig. 50, objects 13 and 14), several jaws, femora, tibiae, clavicles, and humeri, with two ulnas showing unnatural bone growth, as belonging to *Adelonycteris fusca*, and a humerus and ulna with several bones as those of *Vespertilio gryphus*.

Of the 50 deer bones found, 20 were split as if for the purpose of extracting the marrow, of which latter three were also gnawed, while two were split, gnawed, and scorched. Twelve unsplit fragments were gnawed and one scorched. On or about the surface were found 8 vertebrae of the rattlesnake (*Crotalus*), 4 vertebrae of the water snake (*Natrix* or *Eutaenia*), and at least 250 bones with fragments of skulls and teeth of bats. Below Layer 1 the comparatively finer brown cave earth of

Layer 2 (2 to 2½ feet in depth) continued down to the sloping ledges of the rock below. As we worked downward the bits of charcoal grew rarer, and the bone fragments, revealed by the light of candles, became scarce. Nevertheless disturbances seemed to have taken place below 2 feet, particularly along the sides and against the rock, where several bones and pieces of charcoal were found at a depth of 2 to 3 feet below the original surface: the ulna (?) and tibia (gnawed) of a beaver, *Castor fiber;* a lower incisor of the porcupine, *Erethizon dorsatus;* 2 split bones of a deer, *Cariacus virginianus;* and 1 scorched and 3 gnawed bones (undetermined).

The rock bottom revealed at last was very irregular, opening downward into several water-worn fissures about 2 feet in diameter, into which we did not excavate. Nowhere in the cave earth had we found sufficient deposits of charcoal and ashes to indicate the former existence of cooking fires at the spot, and the bones, gnawed, scorched, or split as they often were, seemed to have been brought to their final resting-place by animals who had either preyed upon the leavings of human feasts in the outer cave (as some of the scorched, split bones seemed to indicate), had distributed pieces of carcasses of animals found dead in the dark rooms, or had borne underground their quarry captured in the woods.

Queen Esther's Chamber recalled the dark crannies utilized for the sepulture of charred human bones by Indians in some of the Kentucky and Tennessee caves.[1] But no funereal traces were discovered, and notwithstanding its chimney it was too close and small, too far removed from the daylight to have

[1] A small damp room, accessible by a chasm with a rope, in Peckenpaugh's Cave (left bank of Ohio River at Peckenpaugh's Landing, Meade County, Kentucky), contained numerous charred human bones, with ashes, charcoal, and mussel shells, and the bottom of one of the shallow chasms along the main gallery of Lookout Cave (left Tennessee River bank just below Chattanooga, explored in 1893) was strewn with similar remains. We also found human bones lying upon shelf-like ledges facing the same main passage of the Lookout Cave near the entrance.

served as a feasting site for savages. The vestiges of fire, insignificant as they were, and the seemingly axe-cut limb spoke rather of the remains of torches or random lights kindled in modern times.

To complete the examination of Queen Esther's Chamber it was necessary to remove the floor earth of what might have been called its vestibule (marked "A" in the museum labels upon the specimens discovered), an enlarged bifurcation of the entering passage, opening to the right (west) as you left the top of the step-ladder. About 12 feet long by 4 to 5 feet wide, with irregular sides, and a ceiling extending upward possibly 20 feet into a narrow, dark fissure, its floor was found to contain a bed of cave earth, the removal of which revealed the following layers:

Layer 1 (6 inches to 1 foot), a deposit of disturbed red earth containing near the surface broken pipe-stems of white man's make, burnt sticks, and a fragment of the calcaneum of a deer (*Cervus*). Next below this

Layer 2 (4 feet) showed a closely bedded mass of small limestone fragments containing a number of fine bat bones, but no discovered human trace. Below this

Layer 3 (6 inches to 2½ feet), a deposit of clay loam, rested upon the steeply sloping floor, and followed its irregularities.

Neither in Layer 2 nor in Layer 3 were any traces of hearths or of stained bands representing levels discolored by human presence during or before the deposition of the splinters in the cave. We were left to infer that the scanty signs of disturbance in Layer 1 represented the only period of human occupancy anywhere found, while that some of the charcoal gathered in it (like the seemingly axe-cut branch of Layer 1 in Queen Esther's room) had been placed there by white men rather than Indians, there could be little doubt.

The following is a complete list of the animal and molluscan remains found in the various diggings:

Remains of Animals Found in Durham Cave in September, 1893. Identified by Professor Edward D. Cope.

Note. — Q. E. signifies Queen Esther's Chamber. The depths are given in parentheses.

Chub (*Semotilus*), pharyngeal bone.	Q. E., Layer 1
Catfish (*Amiurus*), pectoral spine .	Q. E., Layer 1
Frog (*Rana*, large), 2 humeri, 2 femora, and ulno-radius	Q. E., Layer 1 (2d foot)
Frog (*Rana*, small), 2 tibio fibulae .	Q. E., Layer 1 (2d foot)
Tortoise (*Cistudo*), piece of carapace	Q. E., Layer 1
Rattlesnake (*Crotalus*), 8 vertebrae .	Q. E., Layer 1, depth undetermined
Water snake (*Natrix* or *Eutaenia*), 4 vertebrae	Q. E., Layer 1, depth undetermined
Snake (undetermined), rib	Trench 1, Layer 2 (5 feet 4 inches)
Grouse (*Bonasa*), skull bones . . .	Q. E., Layer 1, depth undetermined
sacrum and pelvis	Q. E., Layer 1
2 femora	Trench 1, Layer 1 (6 feet)
tibia	Trench 1, not marked
Squirrel (*Sciurus*), humerus . . .	Trench 1 (3 feet)
humerus and tibia	not marked
Beaver (*Castor fiber*), pelvis fibula and astragalus	Q. E., Layer 1
humerus	Q. E., Layer 1
ulna (?)	Q. E., Layer 2
tibia (gnawed)	Q. E., Layer 2
Porcupine (*Erethizon dorsatus*), 3 humeri, lower jaw with 3 molars, scapula, 2 ulnae, and 2 ischiae .	Q. E., Layer 1
lower incisor	Q. E., Layer 2
humerus	Trench 1 (2 feet 8 inches)
radius	Trench 1 (6 feet 10 inches)
femur	Trench 1 (3 feet 3 inches)
upper incisor	Trench 1 (4 feet)
lower incisor and ischium . .	site and depth not marked
Wood mouse (*Peromyscus*), lower jaw and teeth	Trench 1 (3 feet)
upper incisor and various bones	Trench 1 (5 feet 4 inches)

Rabbit (*Lepus*), metatarsal . . .	Trench 1, Layer 2 (7 feet)
ulna, pelvis, humerus, and lumbar vertebra	not marked
Carnivore (undetermined), lumbar vertebra	Q. E., Layer 1
tibia	Trench 3, Layer 1 (6 feet 2 inches
(?) Fox (*Vulpes cinereoargentatus*), tibia	Trench 3, Layer 1 (6 feet 3 inches
Black bear (*Ursus americanus*), canine tooth and lower sectorial molar	Q. E., Layer 1
Wild-cat (*Lynx rufus*), metacarpal (gnawed)	Q. E., Layer 1
Bat (undetermined), ulno-radius, humerus, and numerous bones with a skull	Q. E. surface
Peccary (*Mylohyus pennsylvanicus*), 2 vertebrae of young animals, and part of mandible (much gnawed)	Q. E., Layer 1
Deer (*Cariacus virginianus*), piece of humerus (split and gnawed), ilium (gnawed)	Q. E., Layer 1
temporal bone	Q. E,, depth not marked
calcaneum	vestibule, depth not marked
ungual phalange	place and depth not marked
Elk (*Cervus canadensis*), part of antler (gnawed), possibly an Indian blade-handle	Trench 2, Layer 1 (2 feet)

Remains of Bats Found in Durham Cave in Septemb 1893. Identified by Dr. Harrison Allen.

Adelonycteris fusca, 2 skulls, jaws, femora, tibiae, clavicles, and humeri, with two ulnas showing exostosis	Q. E., on or near the surface
Vespertilio gryphus, humerus and ulna with several bones . . .	Q. E., on or near the surface

Remains of Shells Found in Durham Cave in September, 1893. Identified by Professor H. A. Pilsbry.

Unio complanatus, a small hole broken through the middle . .	Q. E., Layer 1 (1½–2 feet)
Pyramidula alternata Say . . .	Q. E., surface
Polygyra albolabris Say, 2 species .	Q. E., surface
Polygyra albolabris Say	Q. E., depth undetermined
Physa heterostropha Say	Q. E., depth undetermined
Lymnaea catascopium Say, 2 species	Q. E., depth undetermined

A Summary.

Unsatisfactory and unfruitful as much of the digging had been, its results, taken as a whole, had not lacked significance. Having found reason to ascribe great archaeological importance to the site before the destruction of its roof, we had learned that the original rock bottom had not been blasted away, and therefore offered to the future investigator a chance for the discovery of significant human refuse layers somewhere under the recent rubbish in the amphitheatre (probably about 300 feet east of the cave pool). Where we had encountered cave earth the sites of our trenches were of necessity unsuited for the revelation of the evidence sought for. In these once dark inner regions we had failed to find anywhere a significant hearth-site, a jasper chip, a potsherd, or an Indian implement of bone or stone. The only valuable evidence consisted of the remains of animals, and though some of these may have been brought to the cave by white men, while not a few may have found their way thither from the forest in the jaws of carnivores, it seemed reasonable to suppose that others (as, for instance, the bones of the bear, elk, deer, and peccary) had constituted part of the refuse of Indian feasts in the outer cave, where, having been found by prowling animals, they had been carried to inner recesses and gnawed while still retaining their juices.

For the geological antiquity of man we had gathered no proof. The unfossilized bones, not more venerable in appearance than those found by me in Indian midden heaps on the Ohio and Tennessee Rivers,[1] were with one exception those of still existing animals, and assigned a comparatively modern date for the presence of any human cave visitor, who, after eating their flesh, had cast them aside. On the other hand, the investigation had supplied paleontology with evidence of value in the discovery of the bones of the extinct peccary (*Mylohyus pennsylvanicus*) mingled with the remains of still existing animals, if not with the contemporary refuse of Indian cookery. The animal indicated by the symphyseal part of the lower jaw with alveoli of teeth, referred to above (see Fig. 51), according to Professor Cope represents a species which "is quite different from any existing peccary, and belongs to a different genus (*Mylohyus* Cope) which is intermediate between *Dicotyles* and *Platygonus*. About the size of the living white-lipped peccary, the animal is of especial interest in view of its late persistence, as it was probably contemporary with the aboriginal so-called Indian. Neither this jaw nor those described by Leidy are fossilized. A peccary not distinguishable from this one, so far as the material permits me to judge, was found by Mr. Mercer in the Port Kennedy bone-fissure, in company with another species of *Mylohyus*."

These are desirable data for the history and genealogy of the peccary, and pertain to an unexplained gap in a kind of testimony which has been thus far either geologically ancient or quite recent. That the peccary was a familiar inhabitant of the area of the United States in Post-Glacial time, that it

[1] A surface Indian refuse heap at Mackers' Station (right bank of Ohio River, 6 miles above the Kanawha's mouth) contained the bones of man, bear, gray fox, dog, elk, calf, opossum, raccoon, turkey, soft-shelled turtle, with unio shells. Another on the left bank of the Tennessee River (near the mouth of the Nickajack Cave, Marion County, Tennessee) contained the remains of deer, tortoise, and rabbit along with the shells of existing fresh-water mollusca.

roamed the North American forests with the tapir, the mastodon, and the fossil sloth is a fact now as well established as the present existence of its modern representatives in subtrop-

FIG. 51 (actual size). — Fragment of the lower jaw and vertebrae of the extinct peccary (*Mylohyus pennsylvanicus*) found with the remains of still existing species (see Fig. 50) in Queen Esther's Chamber, Durham Cave, September, 1893.

ical America. Its bones have been dug out of lead-bearing fissures near Galena, Illinois, and unearthed with the remains of the mastodon in Benton County, Missouri. An almost complete skull reached the Academy of Natural Sciences of

Philadelphia from a saltpetre cave in Kentucky, and Lund exhumed skeletal fragments (representing according to him five species) from the Pleistocene caves of Brazil. The characteristic highly enamelled and many-lobed teeth, sometimes set in complete jaws, have confronted me at various depths in the bone-bearing chasm at Port Kennedy, Pennsylvania, where they were embedded with the remains of the sabre-toothed tiger, the fossil bear, the mastodon, sloth, and horse; and I have found them again at Zirkels' Cave in Tennessee in association with the fossil grizzly bear and tapir.[1] Such evidence, however, refers to an epoch in the past removed by many milleniums from the discovery of America, while to encounter the peccary in existence we must leave his earlier northern habitat altogether, for a region at least as far south as the Red River of Arkansas. Thenceforward to Patagonia, pairs or herds of the well-bristled, hog-like little animals, dark brown in color and from 30 to 40 inches long, represented by the collared *Dicotyles torquatus*, the more pugnacious and larger white-lipped *Dicotyles labiatus*, and the *Dicotyles angulatus*, range the wilder regions of South and Central America and Mexico. To the northward of the Red River limit evidence for the existence of the modern peccary seems to be wanting, and no credited tale of early explorer or modern hunter has to our knowledge asserted its presence in the middle northern or eastern United States since the coming of the white man.

When and how the tribe, which is as characteristic of the New World as is the hog (*Sus scrofa*) of the Old, became

[1] Naturalists, not without disagreement and correction of their own observations (see Leidy, Dicotylinae of America. Trans. Am. Phil. Soc., X., N.S., p. 323, and XI., N.S., p. 97), have attributed a series of several genera and species, fossil and living, to this animal, based on variations in the skull, the number and shape of the molar and incisor teeth, and the strength of the canines. Flower and Lydekker (see Animals Living and Extinct. London, Black, 1893) are disposed to reduce the genera to one, namely, *Dicotyles*, but Professor Cope gives me the following list of genera and species:

extinct in the north, and why it migrated southward, are questions still unanswered. We may suppose that its abandonment of the United States is linked with the changes in climate or the vicissitudes, as yet little understood, that attended the melting of the great glacier, with the similar desertion of North America by the tapir and the mysterious extinction of the American horse.

But whatever the cause of this episode in the fate of the peccary, the little known period during which the change occurred is of as much interest to the student of man's antiquity as to the paleontologist. For the two sciences it constitutes the meeting-ground, since an earlier fauna perished in it, since

(1) DICOTYLES CUV., distinguished by teeth crowned with tubercles, 6 incisors, and 3 premolars, and represented by 2 fossil and 3 living species, namely,

D. serus (fossil), found in the Miocene deposits of the Loup Fork Epoch;

D. lenis (fossil), found in a mixed or superficial deposit in Maryland;

D. angulatus (living), called the *javalin*, the most northerly species of the series, now ranging Central America and Texas;

D. torquatus (living), the collared peccary, common in South America as far north as Darien; and

D. labiatus (living), the white-lipped peccary, now inhabiting South and Central America.

(2) MYLOHYUS COPE, distinguished by tubercular teeth, 4 incisors, 3 premolars, and weak canines, and represented by 2 species, both fossil, namely,

M. pennsylvanicus, attested by the remains from Durham Cave, described above, and found at Port Kennedy; and

M. nasutus, from Pleistocene deposits in the United States.

(3) PLATYGONUS LEC., distinguished by teeth with fused tubercles and resembling those of the tapir, 4 incisors, and 3 premolars, and represented by 4 species, all fossil, namely,

P. vetus, found in a limestone crevice in Mifflin County, Pennsylvania;

P. compressus, common in Pleistocene deposits;

P. bicalcaratus, found in the Pliocene beds of Texas; and

P. altamirani, discovered in the late Tertiary deposits of Mexico.

(4) BOTHROLABIS COPE, distinguished by tubercular teeth, 6 incisors, and 4 premolars, and represented by 4 species, all fossil, namely,

B. pristinus,

B. trichaenus,

B. rostratus,

B. subaequans, all from the middle Miocene beds of Oregon.

soon or late in it man appeared, coming from an undetermined direction, widening the sphere of his existence in a way as yet unexplained, and bearing a still unknown relation to extinct animals. If it is worth the pains of archaeology to penetrate into this domain of the naturalist and seek to fix a geological date for the advent of humanity in the New World, then discoveries like this at Durham Cave are important, and prepare us to establish landmarks in the pre-Columbian darkness.

We had found a peccary who had undoubtedly far outlived the epoch usually attributed to the animal, and to suppose that the Indian had encountered it was no more unreasonable than to suppose that he had encountered the common deer represented by the cracked bones lying near. Yellow and fresh-looking, the jaw and vertebrae presented no greater appearance of antiquity than the surrounding remains of recent animals, which like them had been gnawed by rodents while still fresh enough for food.

Modernized by their surroundings, they failed to lend the color of an older genealogy of animals to the situation. As in the case of the sloth of Big Bone Cave, Tennessee,[1] as with the tapir and mylodon at the Lookout Cavern,[2] as with the superficial mammoth remains at Big Bone Lick, or as evidenced in the Indian picture-writing known as the Lenape Stone,[3] they present us with a reason for supposing that, in some cases at least, the process of extinction was gradual, and that not a few representatives of the more ancient epoch survived their fellows.

[1] See Preliminary Report distributed by the University of Pennsylvania for June 4, 1896; also American Naturalist for July, 1896, and Scientific American for a July issue, 1896.

[2] See bulletin of Cave Exploration distributed by the University of Pennsylvania for July 4, 1894.

[3] Regarded as a fraudulent relic by Dr. D. G. Brinton on general principles, but whose authenticity I cannot find just reason to doubt. See The Lenape Stone, or the Indian and the Mammoth. By H. C. Mercer. New York, Putnam, 1883.

At Hartman's Cave, fifty miles up the river, Mr. T. D. Paret (see Annual Report of Geological Survey of Pennsylvania, 1887, Cave Fossils, p. 1, plate II) found a fresh-looking jaw of a peccary identical in species with the Durham Cave animal, and described by Leidy as *Dicotyles pennsylvanicus* (by Cope as *Mylohyus pennsylvanicus*), associated with the extinct *Castoroides ohioensis* and the migrated caribou and bison; also with the modern lynx, gray fox, skunk, weasel, raccoon, mole, bat, woodchuck, porcupine, beaver, muskrat, gray squirrel, ground squirrel, meadow mouse, white-footed mouse, wood rat, gray rabbit, deer, and elk.[1] But at Durham the association as far as it goes appears yet more modern, and seems conclusively to set a limit to our conception of the antiquity of one species at least of the northwardly extinct animal in question, which thus within a comparatively few centuries seems to have been a denizen of the Pennsylvanian forest.

[1] Also wild turkey, box turtle, snapper, several snakes, and the shells of the snails, *Helix albolabris*, *H. alternata*, and *H. tridentata*, and the river mussel, *Unio complanatus* and *Margaritina margaritifera*, not now found in the neighboring Delaware River, with the seeds of dogwood, pignut, and walnut.